# SOIL AND WATER CONSERVATION NEEDS – A NATIONAL INVENTORY

MISCELLANEOUS PUBLICATION NO. 971

U. S. DEPARTMENT OF AGRICULTURE

# SOIL AND WATER CONSERVATION NEEDS – A NATIONAL INVENTORY


Prepared by the
CONSERVATION NEEDS INVENTORY COMMITTEE
of the U.S. DEPARTMENT OF AGRICULTURE

Agricultural Stabilization and Conservation Service
Agricultural Research Service
Economic Research Service
Federal Extension Service
Farmers Home Administration
Forest Service
Soil Conservation Service
Statistical Reporting Service



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# Contents

## *Highlights*

The National Inventory of Soil and Water Conservation Needs shows that nearly two-thirds of the non-Federal rural land of the United States needs conservation treatment of some kind.

Nearly 888 out of 1,433 million acres in the 48 mainland States, or 890 out of 1,437 million acres in the entire United States, needs conservation treatment.

In either case, the land needing treatment is 62 percent of the non-Federal land expected to be in agricultural use by 1975. It includes 62 percent of the cropland, 73 percent of the non-Federal pasture and range, and 55 percent of the non-Federal forest and woodland.

Of the 12,711 small watersheds identified in the U.S. mainland, 8,323 or 65 percent need project action which requires government and private cooperation to deal with flood prevention and water problems. Of 70 watersheds in Hawaii, 35 need projects.

Inventory estimates are based on data obtained from mapping soils and land use as they were in 1958 on sample areas that were selected to provide adequate statistical sampling of every rural county in the United States, Puerto Rico, and the Virgin Islands. Needed conservation treatments were estimated to include land use changes expected by 1975.

### LAND INCLUDED IN THE INVENTORY

The Conservation Needs Inventory (CNI) covered all rural (i.e. not urban or built-up) land area in private ownership or owned by States or other local governments, on all of which the U.S. Department of Agriculture is authorized to assist with conservation programs. In this report this land is termed "non-Federal rural" land.

The Inventory acreage accounts for 76 percent of the land in the 48 mainland States and 64 percent in the 50 States. The difference is explained by the large proportion of Alaska in Federal ownership.

In the 48 mainland States, non-Federal rural land amounts to 1,448 million acres. Not included are nearly 51 million acres of urban and built-up areas; 7 million acres of farm ponds, small reservoirs, and other small water areas included as land area by the Census; and 396 million acres of Federal land. Including Alaska and Hawaii, the total non-Federal rural land is 1,453 million acres, and the total Federal land is 761 million acres.

The following highlights of the CNI findings present only the totals for the U.S. mainland. The figures for Alaska and Hawaii are in the text tables. For most items, except forest and woodland, their inclusion does not change the national totals when rounded to millions of acres.

Throughout the main text, the total for the 50 States including Alaska and Hawaii is given first, then the U.S. mainland total in parentheses. Separate data for each State and for Puerto Rico and the Virgin Islands are published in *Basic Statistics of the National Inventory of Soil and Water Conservation Needs* (USDA–CNI 1962).

### LAND CAPABILITY

About half of the Nation's non-Federal rural land is suitable for cultivation. The other half is better suited to uses that keep it in permanent vegetation.

Classification by land capability shows that 44 percent or 637 million acres is suitable for regular cultivation (class I–III); 12 percent or 169 million acres is marginal and is suitable for occasional or limited cultivation (class IV); and 44 percent or 641 million acres is generally not suitable for cultivation (class V–VIII).

Three percent or 36 million acres is in class I—land that is suitable for most common agricultural crops and can be safely cultivated without conservation treatment. The remaining 97 percent requires soil and water conservation treatment of some intensity when devoted to any agricultural use.

Of the land suitable for regular cultivation (class I–III), 58 percent is now used for cropland, 18 percent for pasture and range, 20 percent for forest and woodland, and 4 percent for other agricultural uses.

Twenty-nine percent or about 49 million acres of the marginal, class IV land is being used for cropland, but it presents a continuing problem of limited or uncertain yields and requires intensive treatment for conservation. The remainder is in noncrop uses to which it is better suited.

About 265 million acres of class I–III land and 120 million acres of class IV land are now in noncrop uses. This gives the Nation a reserve of some 385 million acres that could be brought into cultivation if needed for that purpose.

About half (49 percent) of the land not generally suitable for cultivation (class V–VIII) is now used for pasture and range, about two-fifths (42 percent) for forest and woodland, 4 percent for cropland, and 5 percent for other uses. The 4 percent in cropland amounts to 25 million acres. This acreage, although small, presents one of the pressing conservation problems of the day, for it needs either to be shifted to other uses or to be safeguarded by extraordinary measures to avoid serious deterioration.

## MAJOR CONSERVATION PROBLEMS

Susceptibility to soil erosion is the most widespread conservation problem limiting the land capability. It is the dominant problem on about one-half (51 percent), or 738 million acres of the area included in the Conservation Needs Inventory.

Unfavorable soil conditions in the root zone make up the second most prevalent limitation on capability. This is the dominant problem on about a fourth (24 percent) or 352 million acres.

Excess water, either in the soil or on the surface, is the dominant conservation problem on 17 percent or 246 million acres.

Adverse climate is the dominant limitation on 5 percent or 75 million acres.

Class I land, amounting to 3 percent of the total, has no conservation problems.

## PRESENT LAND USE

Non-Federal rural land in the 48 mainland States at the time of the Inventory (1958) was used as follows:

447 million acres as cropland, or 31 percent

485 million acres as pasture and range, or 33 percent

450 million acres as forest and woodland, or 31 percent

66 million acres as "other land," or 5 percent.

About 37 million acres of cropland in the 18 Western States, including Hawaii, was irrigated in 1958.

## EXPECTED CHANGES IN LAND USE

Changes in land use expected by 1975, under conditions and programs in effect at the time of the Inventory (1958), would affect large acreages but would result in small net changes in each land use.

Expected shifts in land use would decrease cropland by 11 million acres or 3 percent, increase pasture and range by 13 million acres or 3 percent, decrease forest and woodland by 10 million acres or 2 percent, and decrease other land by 6½ million acres or 11 percent. Total non-Federal rural land would decrease 15 million acres or 1 percent.

A total of 122 million acres, however, would change from one use to another before 1975, requiring the establishment of new vegetation and new conservation practices on about 8½ percent of the Nation's non-Federal rural land in about 15 years. This would include 31 million acres of new cropland replacing 42 million acres converted to other uses; 45 million acres of new pasture and range replacing 32 million acres; 19 million acres of new forest and woodland replacing 29 million acres; and 7½ million acres of other land replacing 14 million acres.

In addition to the shifts between agricultural uses, more than 5 million acres is expected to come into agricultural use, mainly from Federal land in the West, while 21 million acres is converted to nonagricultural uses.

Accelerated programs of land conversion since the Inventory have speeded up the rates of change in land use. In 1962 the Land and Water Policy Committee of the Department of Agriculture estimated that the Nation's farm production needs in 1980 could be met with 51 million acres less cropland than was reported in 1958, and current agricultural policy is aimed at encouraging this conversion.

## CONSERVATION TREATMENT NEEDS ON CROPLAND

More than 25 million acres or nearly 6 percent of cropland in 1958 was land generally not suitable for cultivation (class V–VIII). Another 49 million acres or 11 percent was land suitable for only occasional or limited cultivation (class IV) and requiring intensive conservation practices. These 74 million acres in cropland are better suited to other uses that provide a permanent vegetative cover. A major conservation problem is to convert them to such uses or to provide the necessary conservation measures on a continuing basis for the portions kept in cultivation.

Nearly 31 million acres expected to be converted to cropland by 1975 will need preparation for cultivation and establishment of new conservation practices. About 20 million acres of the new cropland will come from pasture and range, 7½ million from forest and woodland, 2½ million from other non-Federal land, and 1 million from Federal land. About 4 million acres will be class IV land requiring intensive conservation treatment for occasional or limited cultivation, and 2½ million acres of class V–VIII land requiring unusually intensive preparation and treatment for use for specialty crops.

Of the 437 million acres expected to be used as cropland in 1975, 408 million acres or 93 percent has some conservation problem that limits its use and 272 million acres or 62 percent needs conservation treatment of some kind. About 28 million acres has no conservation problems, and 136 million acres or 31 percent has been adequately treated.

On the 408 million acres of cropland with any problem hazard of erosion is the dominant problem on 234 million acres or 57 percent,

excess water on 94½ million acres or 23 percent, unfavorable soil on 55 million acres or 14 percent, and adverse climate on 24½ million acres or 6 percent.

On the 272 million acres of cropland still needing conservation treatment, the dominant problem is erosion hazard on 161½ million acres or 60 percent, excess water on 60 million acres or 22 percent, unfavorable soil on 36½ million acres or 13 percent, and adverse climate on 14 million acres or 5 percent.

Erosion hazard is the most widespread problem on cropland. It is the dominant problem on 234 million acres and a secondary problem on 59 million acres, a total of 293 million acres or 72 percent of the cropland with any problem. Of the cropland with erosion as the dominant problem, 179 million acres or 77 percent is affected mainly by water erosion and 55 million acres or 23 percent by wind erosion. About 161 million acres or 69 percent of the cropland with erosion the dominant problem needs conservation treatment, 125 million principally for water erosion and 36 million acres for wind erosion.

Excess water is the dominant conservation problem on 94½ million acres of cropland and a secondary problem on 18 million acres, a total of 112½ million acres or 28 percent of cropland with any problem. Sixty million acres or 63 percent of cropland with excess water as the dominant problem still needs conservation treatment.

Unfavorable soil conditions in the root zone is the dominant problem on 55 million acres and a secondary problem on 66 million acres, a total of 121 million acres or 30 percent of cropland with any problem. About 36½ million acres or 66 percent of the cropland with unfavorable soil as the dominant problem needs treatment.

Adverse climate is the dominant problem on 24½ million acres and a secondary problem on 40 million acres, a total of 64½ million acres or 16 percent of cropland with any problem. About 14 million acres or 58 percent of cropland with adverse climate as the dominant problem needs treatment.

About 37 million acres of cropland in the 18 Western States was irrigated in 1958. This is expected to increase to 45½ million acres in 1975. Of this, 38 million acres or 84 percent has a conservation problem and 27 million acres or 59 percent needs treatment.

The dominant conservation problems on irrigated cropland are erosion hazard on 17 million acres, of which 13 million needs treatment; excess water on 5½ million acres, of which 4 million needs treatment; unfavorable soil on 13 million acres, of which 9 million needs treatment; and adverse climate on 2 million, of which 1 million needs treatment.

## CONSERVATION TREATMENT NEEDS ON PASTURE AND RANGE

Nearly three-fourths of the non-Federal pasture and range, including land expected to come into this use by 1975, needs some kind of conservation treatment. Of the 498 million acres expected to be in pasture and range by 1975, 364 million acres needs treatment and is feasible to treat.

As defined in the Conservation Needs Inventory, land in pasture and range does not include grazing land in the crop rotation, or any land having more than 10 percent canopy of woody plants. The Inventory also excludes all Federal land. These estimates of conservation needs, therefore, apply only to non-Federal grassland pasture and range.

About 45 million acres of new pasture and range, expected to be converted from other uses by 1975, will need to be established in grass and to have necessary conservation practices applied. This land will include about equal amounts that are suitable for regular cultivation (classes I–III) and that are unsuited (classes V–VIII). About 55 percent of it will come from present cropland and 32 percent from forest and woodland. At the same time, 32 million acres is expected to be converted from pasture and range to other uses, leaving a net increase of 13 million acres or 3 percent in total non-Federal pasture and range by 1975.

About 27 million acres of the present pasture and range is so badly depleted that it needs to be seeded to establish desirable plant cover.

Altogether, 72 million acres of non-Federal pasture and range needs establishment of cover. About half of this is tame pasture.

More than 107 million acres of existing pasture and range needs improvement of the plant cover by some means short of complete reestablishment.

In addition, 185 million acres needs positive measures to protect already adequate stands of vegetation from one or more of the following hazards: Overgrazing, 163 million acres; fire, 73 million acres; erosion, 32 million acres; rodents, 11 million acres; and noxious and woody plants, 57 million acres. Two or more of these problems may apply to the same acreage, and establishment or improvement of cover is assumed to include necessary protection from these hazards.

Water management practices are needed to help establish or improve desirable plant cover on more than 34 million acres of non-Federal range and pasture. Of this, about 23 million acres needs water conservation, and 11 million acres needs treatment to remove excess water.

## CONSERVATION TREATMENT NEEDS ON FOREST AND WOODLAND

Non-Federal forest and woodland included in the Conservation Needs Inventory makes up about 70 percent of the total 640 million acres in the 48 mainland States and 60 percent of the 774 million acres in the 50 States.

Of the 440 million acres of non-Federal land expected to be in this use by 1975, 241 million acres or 55 percent needs on-site conservation treatment. In addition, varying proportions need improved protection from the hazards of fire, insects and disease, and animal damage.

As defined in the Inventory, forest and woodland includes all land with more than 10 percent canopy of trees and shrubs. This includes a large acreage on which timber stand establishment and improvement measures are impractical but protection is needed for conservation of soil, watershed, forage, wildlife, and other values.

Although expected shifts in land use will convert 19 million acres to forest and woodland by 1975, the net effect of the changes will be to reduce non-Federal forest and woodland by 10 million acres or 2 percent. The new forest and woodland will come about equally from cropland, pasture and range, and "other land." About 38 percent will be in classes I–III, 21 percent class IV, and 41 percent classes V–VIII.

A total of 69 million acres, including the land being converted to forest and woodland, needs establishment of timber stand by planting or natural regeneration. Another 160 million acres needs timber stand improvement measures, such as thinning, culling, pruning, and other cultural treatments.

Erosion-control and water-disposal measures are needed on 12 million acres of forest and woodland.

In addition to these on-site treatments, non-Federal forest and woodland needs improved systems of protection from: Fire, 252 million acres; insects and disease, 207 million acres; and animals including rodents, 82 million acres. These overlap.

Additional shelterbelts and windbreaks are needed on 1 million acres, mainly in the Northern Plains and Lake States regions.

Improved naval-stores methods are needed on 4 million acres in the Southeast and Delta States.

## CONSERVATION TREATMENT NEEDS ON "OTHER LAND"

More than 66 million acres or nearly 5 percent of non-Federal rural land, classified as "other land" in the Inventory, is made up of farmsteads, wildlife areas, recreation developments, idle land, and other areas not used as cropland, pasture and range, or forest and woodland.

Although Inventory committees estimated that the acreage of this land would decline to 60 million acres by 1975, recent emphasis on use of agricultural land for recreation enterprises may tend to offset the decrease.

More than a fourth of "other land" or 18 million acres is of capability class VIII and is devoted chiefly to wildlife and recreation. The other 48 million acres falls in the various capability classes in about the same proportion as all non-Federal rural land.

About 10½ million acres or 17 percent of "other land" needs conservation treatment and is feasible to treat. Because of the miscellaneous uses of this land, a large proportion does not require the intensive treatments needed on similar land used for cultivation, woodcrops, or grazing.

Erosion is the most widespread conservation problem on "other land." Actual or potential erosion is the dominant problem on 23 million acres or 38 percent of the total; excess water is the dominant problem on 16 million acres; unfavorable soil on 17 million acres; and adverse climate on 4 million acres.

## NONAGRICULTURAL LAND

Of the 21 million acres expected to go out of agricultural use by 1975, 16 million will go into urban and built-up areas. Specialized soil and water conservation treatments will be needed for the new urban and built-up areas, since urbanization commonly alters natural drainage patterns and increases runoff and erosion hazards.

Almost half of these areas, or nearly 7 million acres, will come from cropland; 3 million from pasture and range; 4 million from forest and woodland; and 2 million from "other land."

## WATERSHED PROJECT NEEDS

The watershed inventory included Federal land, since effective watershed treatment requires consideration of all land (private and public, rural and urban) draining to a stream.

To determine watershed project needs, Conservation Needs Inventory Committees subdivided the Nation's major river basins into small watersheds of less than 250,000 acres, the statutory size limit of projects under the Watershed Protection and Flood Prevention Act (Public Law 566). On this basis, they delineated 12,711 watersheds in the 48 mainland States as possible planning units. No watershed inventory was made in Alaska, and parts of some States were not mapped in detail because of the absence of watershed problems.

The total land and water area within the delineated watersheds was 1,993 million acres. The average size of the watersheds is approximately 150,000 acres.

A total of 8,323 or 65 percent of the delineated watersheds—amounting to slightly more than 1 billion acres—need project action for one or more of the specific flood-prevention or water-management purposes. These projects require cooperation between government units, local organizations, and individual landowners.

Flood prevention is the most widespread project need. A total of 6,343 watersheds need projects for reducing floodwater and sediment damages. Of a total of 126 million acres of flood plain, 63 million acres needs protection by project action. The projects would benefit about 950,000 farms.

Critical-erosion hazards that would endanger watershed project structures, reservoirs, and flood plain property exist on 75 million acres. About a third of this or 23 million acres needs project action for effective treatment. A total of 6,651 watersheds need projects for critical-erosion control which would benefit nearly 505,000 farms.

In 3,931 watersheds, project action is needed to provide group drainage outlets and improvements benefiting 45½ million acres on more than 549,000 farms.

Project action is needed in 2,611 watersheds for irrigation development to provide adequate water for 15 million acres on 219,000 farms. The Inventory indicates that 67 million acres has suitable soil and potential water supply for irrigation.

A total of 823 watersheds were reported as needing water-supply development and 1,995 needing recreation development. Subsequent experience in preparing project work plans indicates that these estimates are less than actual needs under current program standards.

## SUMMARY OF CONSERVATION NEEDS INVENTORY, 48 U.S. MAINLAND STATES

### NON-FEDERAL RURAL LAND

| Land use | Total area, 1958 | | Land capability: Suitable for regular cultivation | | Land capability: Suitable for limited cultivation | | Land capability: Generally not suitable for cultivation | | Expected area, 1975 | | Needing treatment | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* |
| Cropland | 447,399 | 31 | 373,110 | 58 | 48,910 | 29 | 25,378 | 4 | 436,185 | 30 | 271,843 | [1] 62 |
| Pasture and range | 484,716 | 33 | 113,323 | 18 | 53,860 | 32 | 317,525 | 49 | 497,154 | 35 | 364,163 | [1] 73 |
| Forest and woodland | 449,651 | 31 | 124,301 | 20 | 58,106 | 34 | 265,991 | 42 | 439,682 | 31 | 241,309 | [1] 55 |
| Other land | 66,271 | 5 | 26,360 | 4 | 7,828 | 5 | 31,903 | 5 | 59,766 | 4 | 10,314 | [1] 17 |
| Total | 1,448,037 | 100 | 637,094 | 100 | 168,703 | 100 | 640,796 | 100 | 1,432,787 | 100 | 887,629 | [1] 62 |

### SMALL WATERSHEDS

| Item | Total | Needing projects for—: All purposes | | Flood prevention | | Erosion control | | Drainage | | Irrigation | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *Amount* | *Percent* | *Amount* | *Percent* | *Amount* | *Percent* | *Amount* | *Percent* | *Amount* | *Percent* |
| Number | 12,711 | 8,323 | 65 | 6,343 | 50 | 4,651 | 36 | 3,931 | 31 | 2,611 | 21 |
| Area (1,000 acres) | 1,922,592 | 1,000,719 | 50 | ------- | -- | ------ | -- | ------- | -- | ------ | -- |
| Having problem (1,000 acres) | --------- | --------- | -- | 125,741 | -- | 75,518 | -- | 172,468 | -- | 66,801 | -- |
| Needing projects (1,000 acres) | --------- | --------- | -- | 62,580 | [2] 50 | 23,404 | [2] 31 | 45,537 | [2] 26 | 14,658 | [2] 22 |

[1] Of total land in use indicated, 1975.

[2] Of area having problem.

## SUMMARY OF CONSERVATION NEEDS INVENTORY, UNITED STATES

### NON-FEDERAL RURAL LAND

| Land use | Total area, 1958 | | Land capability: Suitable for regular cultivation | | Land capability: Suitable for limited cultivation | | Land capability: Generally not suitable for cultivation | | Expected area, 1975 | | Needing treatment | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* |
| Cropland | 447,737 | 31 | 373,328 | 58 | 48,993 | 29 | 25,415 | 4 | 436,592 | 30 | 272,080 | [1] 62 |
| Pasture and range | 485,364 | 33 | 113,393 | 18 | 53,938 | 32 | 318,025 | 49 | 497,958 | 35 | 364,797 | [1] 73 |
| Forest and woodland | 452,729 | 31 | 124,907 | 20 | 58,413 | 34 | 268,154 | 42 | 441,531 | 31 | 242,371 | [1] 55 |
| Other land | 67,042 | 5 | 26,380 | 4 | 7,838 | 5 | 32,644 | 5 | 60,553 | 4 | 10,358 | [1] 17 |
| U.S. total | 1,452,872 | 100 | 638,008 | 100 | 169,182 | 100 | 644,238 | 100 | 1,436,634 | 100 | 889,606 | [1] 62 |

### SMALL WATERSHEDS

| Item | Total | Needing projects for—: All purposes | | Flood prevention | | Erosion control | | Drainage | | Irrigation | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *Amount* | *Percent* | *Amount* | *Percent* | *Amount* | *Percent* | *Amount* | *Percent* | *Amount* | *Percent* |
| Watersheds (number) | 12,781 | 8,358 | 65 | 6,364 | 50 | 4,661 | 36 | 3,937 | 31 | 2,625 | 20 |
| Total area (1,000 acres) | 1,926,617 | 1,002,330 | 50 | ------- | -- | ------- | -- | ------- | -- | ------- | -- |
| Having problem (1,000 acres) | ---------- | ---------- | -- | 125,754 | -- | 75,670 | -- | 172,472 | -- | 66,929 | -- |
| Needing projects (1,000 acres) | 1,003,228 | ---------- | -- | 62,591 | [2] 50 | 23,501 | [2] 31 | 45,539 | [2] 26 | 14,686 | [2] 22 |

[1] Of total land in use indicated, 1975.
[2] Of area having problem.

## *Introduction*

In the past two decades, new skills in the use of new machines, new fertilizers, and new production chemicals have enabled a decreasing number of farm operators to produce an increasing supply of food and fiber for the Nation's consumers. Today, one farm worker supplies food, fiber, and other products for 30 other people. Widespread use of soil and water conservation practices and shifting of cultivation from unsuitable to suitable soils have helped farmers harvest bigger crops from fewer acres. Although much land is still inadequately treated or improperly used, the prospect of a land shortage in the near future has been allayed.

But the era of abundance is not altogether an era of satisfaction. Consumers are better fed and better clothed than ever before—and at a smaller part of their total income—but they find themselves increasingly wanting other satisfactions that the land can give.

The 70 percent of the population who live in cities and towns contend with mounting problems of air pollution, water shortage, and traffic congestion. They demand more public parks and reserved areas where they can satisfy a growing yearning for outdoor recreation. They seek ways to enjoy the quiet and freshness of the open spaces occupied by the other 30 percent who are rural residents.

At the same time, farmers' incomes have not kept pace with farmers' productivity nor with the incomes of nonfarmers. The very abundance produced by the efficiency of farmers depresses their markets. As a result, many rural communities suffer economic stagnation and restricted opportunities for their citizens.

Local planning bodies and technical panels need specific data on all aspects of their community's physical and economic resources, to develop coordinated plans for improvement. Detailed knowledge of the land and water resources of a community is needed so that these resources can be used to serve the needs of the people fully and to provide satisfying services to urban residents with profit to the local economy.

### THE CONSERVATION NEEDS INVENTORY

The U.S. Department of Agriculture (USDA) is committed to a policy of strengthening rural America. The goal is to help rural communities use their available resources to satisfy the wants of the total population and provide economic benefit to landowners and operators and to the businesses that depend on them.

The Congress has endorsed this policy by enacting new legislation authorizing a wide range of expanded activities in resource conservation and development, cropland conversion, rural recreation, rural renewal, watershed protection, and other endeavors.

In April 1956 the Secretary of Agriculture directed the USDA agencies with major responsibilities for land use and conservation to cooperate in making "reasonable estimates of the magnitude and urgency of the various conservation measures needed to maintain and improve the country's productive capacity for all the people." (Secretary's Memo. 1396, Apr. 10, 1956.)

The National Inventory of Soil and Water Conservation Needs was organized under the leadership of the Soil Conservation Service. Other agencies participating were Agricultural Conservation Program Service,[1] Agricultural Marketing Service,[1] Agricultural Research Service,[1] Commodity Stabilization Service,[1] Federal Extension Service, Farmers Home Administration, and Forest Service.

A USDA Soil and Water Conservation Needs Committee was established with members from each of the designated agencies and with chairmanship in the Soil Conservation Service. This committee developed policies and procedures for making the inventory and reviewed and approved data from the States. Conservation Needs Inventory (CNI) Committees of similar membership were set up in each State and county. Altogether, some 30,000 professional agricultural workers in 3,000 counties participated in the Inventory.

The USDA committee provided information on land use and ownership from the 1954 Census of Agriculture for State committees to use in making the Inventory estimates. It also prepared a set of basic assumptions regarding population growth and economic development as guides in projecting land use trends to 1975.

Each State then developed within the National guidelines its own economic assumptions and procedures, and county Inventory committees refined these to fit conditions peculiar to their local areas. Review procedures were

[1] Reorganization of the USDA in 1961 replaced these agencies as participants by the Agricultural Stabilization and Conservation Service, Economic Research Service, and Statistical Reporting Service.

established to assure similar estimates for areas having similar agricultural potentials.

The Soil Conservation Service, with the assistance of some State experiment stations, made soil surveys and interpreted basic data on soils and land use for statistically selected sample areas in each county. Statistical laboratories at Cornell University and Iowa State University selected the samples. These two laboratories and one at Texas A. and M. assisted the State committees in processing and analyzing the basic data. They measured the delineations of soil, slope, erosion, and land use on the sample area maps and expanded these data to the areas represented.

In Washington, the Statistical Reporting Service processed county and State data for the State and National summaries and reports. Also, the USDA committee reviewed and coordinated the State estimates for present (1958) and expected (1975) land use and conservation treatment needs and accepted the final data when they met required standards.

**Land included in the Inventory**

The Conservation Needs Inventory is concerned primarily with private agricultural land and associated rural areas. This is land of concern in public resource use and conservation programs involving individual citizens and local governments to which USDA can give assistance. (Information for the National Forests and other Federal lands is collected in separate studies by the responsible administering agencies.) All land, both private and public, was included in the Inventory of watershed project needs.

Except for the watershed inventory, therefore, the CNI included all non-Federal rural land in the United States and excluded Federal land and urban and built-up areas.

The 1954 Census of Agriculture was used as the basic information on total land area. The "inventory acreage" of each county was determined as follows:

First, the State committees determined a base figure for each county by subtracting the acreage of Federal land (supplied by the appropriate Federal agencies) from the total land area.

From its base figure, each county committee subtracted the acreage of urban and built-up areas and of water areas in the county. Urban and water acreages were determined locally from basic data obtained from the soil surveys of sample areas and other sources. (The base figures and resulting "inventory" acreages were later revised to agree with 1959 census land area figures.)

Data from all sample areas were expanded, and information from other sources adjusted as necessary to equal the adopted inventory acreage in each county.

State and National "inventory" acreages, referred to in this report as "non-Federal rural land," are summations of the adopted county figures.

The Inventory, then, includes all privately owned land, Indian land, and land owned by States, counties, and municipalities that is not in urban or built-up areas or covered by water.

**Inventory reports**

This report presents a summary and analysis of the CNI findings and tabular data for the 10 farm production regions used in summarizing the data. National data are totaled separately for the 50 States including Alaska and Hawaii and for the 48 mainland States.

Statistical data for each of the 50 States and for Puerto Rico and the Virgin Islands are published in *Basic Statistics of the National Inventory of Soil and Water Conservation Needs* (USDA 1962). That volume also contains detailed descriptions of procedures and definitions of items included in the tables.

A graphic summary of the major CNI findings for the 48 mainland States is published in *Agricultural Land Resources — capabilities, uses, conservation needs* (USDA 1962a).

Each State committee prepared a State report that includes a summary of basic data for the State and for each county. Nearly all of the State reports have been published; the others will be. Some county reports have been published, but Inventory data for most counties are published only in the State reports.

Soil Conservation Service offices have official files of CNI data for the areas (counties, States, etc.) that each serves. These records can be consulted in the offices by people who need information that is not readily available in published form.

Arrangements for special summaries of data can be made through the State or National offices of the Soil Conservation Service. Persons or agencies requesting such summaries would bear the cost.

Basic soil data obtained from surveys of the sample areas are recorded on data processing cards, and selected portions or combinations can be summarized for special purposes. Estimates of the CNI committees on present and expected land uses and certain items of the watershed inventory are on data processing cards and can be summarized by different areas than those used in the Inventory reports.

# Part I. Our land resources

## *Land Capability and Land Use*

In the Conservation Needs Inventory (CNI) the basic soil data from the sample areas in every county were interpreted in terms of the land-capability classification established by the Soil Conservation Service (Klingebiel 1961).

The Conservation Needs Inventory provides estimates of the amount of land in each of these categories nationally, by regions, and by States. The precise location of each kind of soil, however, requires detailed soil surveys of all the land. Standard soil surveys for the entire country, therefore, need to be completed at an early date to provide a guide to needed shifts in land use and to conservation treatments.

### LAND-CAPABILITY CLASSIFICATION

The land-capability classification is an interpretive grouping of soils made primarily for agricultural purposes. It begins with the individual soil-mapping units. It provides three major categories: (1) Unit, (2) subclass, and (3) class.

The land-capability unit is a grouping of the individual soil mapping units that are adapted to the same kinds of cultivated crops or pasture plants and that require similar management for these crops or plants.

The land-capability subclass is a grouping of land-capability units having similar *kinds* of limitations or hazards. Four kinds of limitations or hazards are identified: (1) Erosion hazard, (2) excess water or wetness of soil, (3) unfavorable soil in the root zone, and (4) adverse climate.

The third (and broadest) category places the soils in eight land-capability classes. The risks of soil damage or the limitations in use become progressively greater from class I to class VIII (fig. 1 and 2).

Soils in classes I-IV are capable of producing adapted cultivated field crops, as well as other adapted plants. Soils in classes V, VI, and VII are generally suited to the use of adapted pasture or range plants or trees. Some are also capable of producing specialized crops, such as certain fruits and ornamentals, and even field and vegetable crops under highly intensive management involving elaborate practices for soil and water conservation. Soils in class VIII do not return on-site benefits for inputs of management of crops, grasses, or trees without major reclamation.

The capability classification of the soils in an area may be changed when major reclamation projects are installed that permanently change the limitations in use or reduce the hazards or risks of soil or crop damage. Examples include establishing major drainage facilities, building levees or flood-retarding structures, providing water for irrigation, removing stones, or large-scale grading of gullied land.

The classification is based on current knowledge of the use and management of soils—which is constantly changing with the progress of research and experience. The groupings are subject to change as new information about the behavior and responses of soils becomes available.

The land-capability interpretations in this report are based on criteria in use locally at the time the Inventory was made. Some States made their interpretations before the Soil Conservation Service issued new National guides to improve uniformity in the interpretations.[2] Later revisions to reconcile differences between adjoining States are not included in this report but are available in data in the States and can be consulted.

The CNI shows that the Nation's non-Federal rural land is about equally divided between classes suitable for cultivation and those better suited to permanent vegetation (fig. 3). Practically all of it requires conservation treatment of some kind for sustained production in whatever use it may be kept.

Land in class II and class III, both suitable for continuous and fairly intensive cultivation with appropriate conservation treatment, makes up 20 and 21 percent, respectively, of the total non-Federal rural land (table 1). Together, they amount to 601.8 million acres in the 50 States including Alaska and Hawaii (600.9 million in the 48 mainland States). These classes are matched by almost equal amounts of class VI and class VII land that is not generally suitable for cultivation but can be used for grazing, forestry, or other purposes with proper conservation measures. These classes make up 19 and 20 percent of the

[2] Soil Memorandum SCS–22 and SCS–30.


*Figure 1.*—**Land-capability classes.** CAL-6571

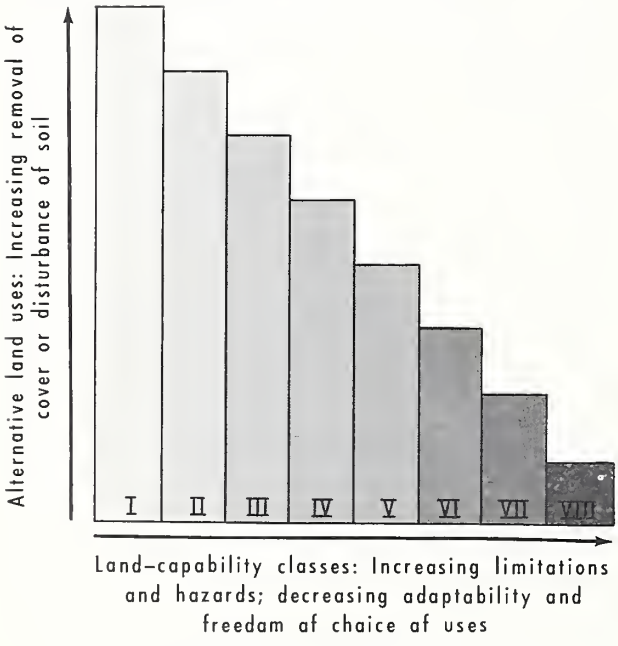


*Figure 2.*—**Relation of land limitations and land-capability classes to safe land use.**

total and have a combined acreage of 573.9 (571.0) million acres.

Class IV, which is marginal for cropland, amounts to 169.2 (168.7) million acres or 12 percent of the total. Only 3 percent or 36.2 million acres is class I land requiring no conservation treatment, and 27.2 (26.7) million acres is class VIII that is unsuitable for commercial plant production. Another 3 percent or 43.0 million acres is class V land, which requires no conservation treatment when kept in permanent vegetation but is generally unsuitable for cultivation.

Land use in the United States conforms in general to the land capability, although many adjustments are needed in the interest of soil and water conservation and others could be made to meet future requirements for more intensive production.

Classes I, II, and III are used mainly for cropland, and classes V, VI, and VII are mostly pasture and range or forest and woodland (fig. 4). Some class VI and VII land is cultivated, but its limited capability creates serious conservation problems when it is used for crops.

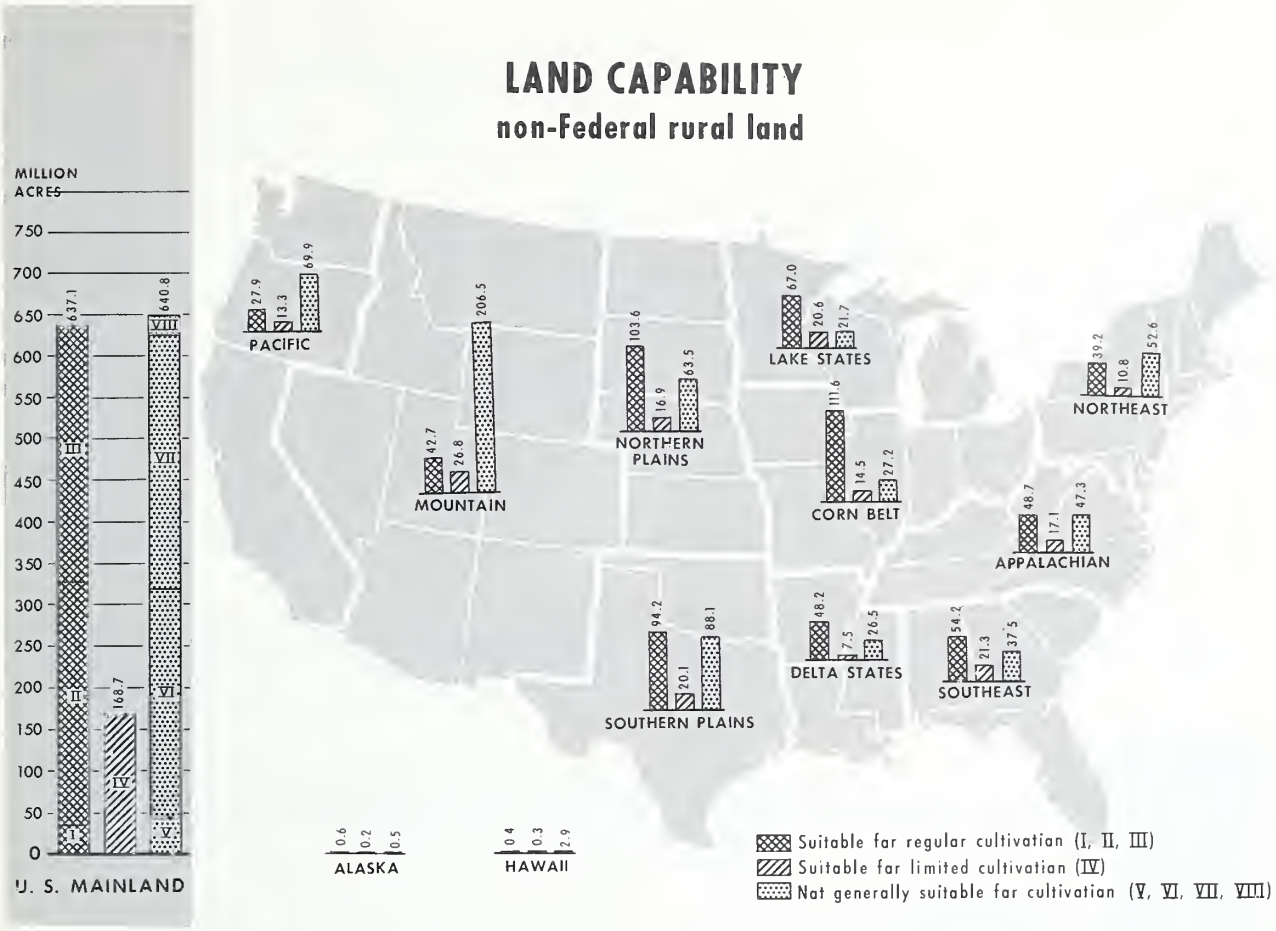


*Figure 3.*

Much of the class II and III land, which is suitable for continuous cultivation, is devoted to pasture and range or forest and woodland; this constitutes a reserve of potential cropland that could be used for production if needed for that purpose.

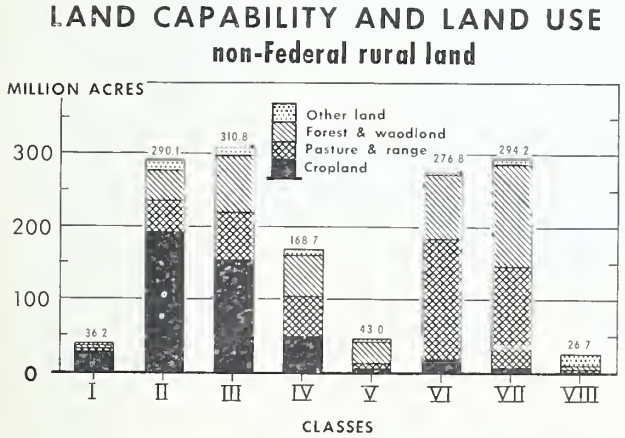


*Figure 4.*

Data on the use of each class of land are presented in more detail in later sections of this report.

## LAND SUITABLE FOR REGULAR CULTIVATION

Of the total non-Federal rural land in the 50 States more than two-fifths or 638 million acres (637.1 million in the 48 mainland States) is suitable for regular cultivation (fig. 3 ). About 36.2 million acres is class I land, which has a minimum of soil management and conservation problems. The remaining 601.8 (609.9) million acres is class II and III land, which requires moderate to intensive treatment for protection, improvement, and sustained production (table 1).

The land suitable for regular cultivation is concentrated in the Corn Belt, Lake States, Delta States, and Northern Plains regions. The Mountain, Pacific, and Northeast regions have the lowest proportions of land suitable for cultivation (fig. 3).

Nearly three-fifths or 373.3 (373.1) million acres of the soil suitable for regular cultiva-

TABLE 1.—*Land capability*

[Because of rounding, some totals may not equal the sum of the

| Region | Suitable for regular cultivation | | | | | | | | Suitable for limited cultivation (class IV) | | Total suitable for cultivation (class I-IV) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class I | | Class II | | Class III | | Class I-III | | | | | |
| | *1,000 acres* | *Per-cent* | *1,000 acres* | *Per-cent* | *1,000 acres* | *Per-cent* | *1,000 acres* | *Per-cent* | *1,000 acres* | *Per-cent* | *1,000 acres* | *Per-cent* |
| Northeast | 1,861 | 2 | 18,103 | 18 | 19,229 | 19 | 39,193 | 38 | 10,848 | 11 | 50,040 | 49 |
| Lake States | 2,419 | 2 | 36,539 | 33 | 28,034 | 26 | 66,992 | 61 | 20,579 | 19 | 87,571 | 80 |
| Corn Belt | 7,656 | 5 | 65,025 | 43 | 38,896 | 25 | 111,577 | 73 | 14,457 | 9 | 126,035 | 82 |
| Northern Plains | 4,546 | 2 | 44,718 | 24 | 54,331 | 31 | 103,595 | 57 | 16,870 | 9 | 120,465 | 66 |
| Appalachian | 2,377 | 2 | 24,429 | 22 | 21,854 | 19 | 48,660 | 43 | 17,057 | 15 | 65,717 | 58 |
| Southeast | 2,323 | 2 | 20,376 | 18 | 31,466 | 28 | 54,165 | 48 | 21,298 | 19 | 75,463 | 67 |
| Delta States | 3,221 | 4 | 17,894 | 22 | 27,049 | 32 | 48,164 | 58 | 7,491 | 9 | 55,654 | 67 |
| Southern Plains | 6,696 | 3 | 41,218 | 20 | 46,284 | 23 | 94,198 | 46 | 20,066 | 10 | 114,264 | 56 |
| Mountain | 2,214 | 1 | 11,045 | 4 | 29,393 | 10 | 42,652 | 15 | 26,779 | 10 | 69,431 | 25 |
| Pacific | 2,860 | 2 | 10,731 | 10 | 14,307 | 13 | 27,898 | 25 | 13,258 | 12 | 41,156 | 37 |
| U.S. mainland | 36,174 | 3 | 290,077 | 20 | 310,844 | 21 | 637,095 | 44 | 168,703 | 12 | 805,797 | 56 |
| Alaska | 0 | 0 | 281 | 22 | 271 | 21 | 550 | 43 | 199 | 16 | 751 | 59 |
| Hawaii | 21 | 1 | 121 | 3 | 221 | 6 | 363 | 10 | 280 | 8 | 643 | 18 |
| U.S. total | 36,195 | 3 | 290,478 | 20 | 311,335 | 21 | 638,009 | 44 | 169,181 | 12 | 807,190 | 56 |

[1] Less than 0.5 percent.

tion are being cultivated (fig. 5, table 2), and about 264.7 (264.0) million acres more are now being used for pasture, woodland, or other non-crop uses. Such land (Class I-III not now being cultivated) is most prevalent in the Southeast, Delta States, and Appalachian re-

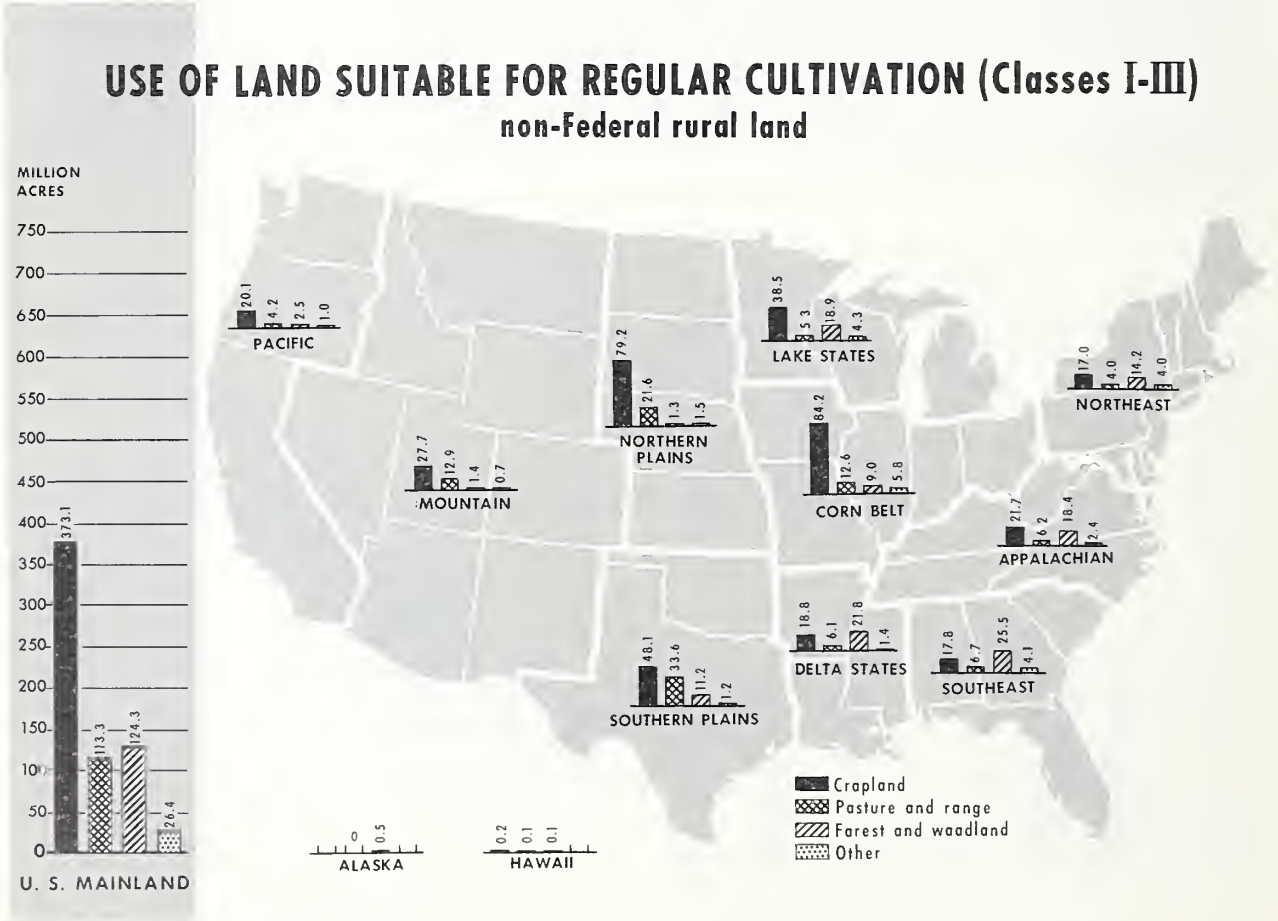


*Figure 5.*

*of non-Federal rural land, 1958*

items listed and data may not check exactly with summary tables]

| Generally not suitable for cultivation | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Class V | | Class VI | | Class VII | | Class VIII | | Total Class V-VIII | | Unclassified | | Total | |
| *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* |
| 122 | (1) | 26,605 | 26 | 23,423 | 23 | 2,426 | 2 | 52,576 | 51 | 27 | (1) | 102,643 | 100 |
| 5,538 | 5 | 4,380 | 4 | 9,661 | 9 | 2,120 | 2 | 21,698 | 20 | 2 | (1) | 109,272 | 100 |
| 1,412 | 1 | 8,970 | 6 | 16,663 | 11 | 194 | (1) | 27,238 | 18 | 0 | 0 | 153,273 | 100 |
| 2,488 | 1 | 37,142 | 20 | 23,314 | 13 | 528 | (1) | 63,472 | 34 | 0 | 0 | 183,937 | 100 |
| 568 | 1 | 14,067 | 12 | 31,966 | 28 | 709 | 1 | 47,310 | 42 | 154 | (1) | 113,181 | 100 |
| 13,169 | 12 | 7,768 | 7 | 15,379 | 13 | 1,139 | 1 | 37,454 | 33 | 102 | (1) | 113,019 | 100 |
| 8,680 | 10 | 3,755 | 5 | 11,718 | 14 | 2,367 | 3 | 26,520 | 32 | 1,159 | 1 | 83,333 | 100 |
| 9,429 | 5 | 37,278 | 18 | 41,384 | 21 | 26 | (1) | 88,117 | 44 | 0 | 0 | 202,381 | 100 |
| 1,137 | (1) | 102,312 | 37 | 93,247 | 34 | 9,788 | 4 | 206,485 | 75 | 1 | (1) | 275,918 | 100 |
| 507 | (1) | 34,533 | 31 | 27,456 | 25 | 7,429 | 7 | 69,925 | 63 | 0 | 0 | 111,081 | 100 |
| 43,050 | 3 | 276,810 | 19 | 294,211 | 20 | 26,725 | 2 | 640,796 | 44 | 1,445 | (1) | 1,448,037 | 100 |
| 0 | 0 | 176 | 14 | 299 | 24 | 44 | 3 | 519 | 41 | 0 | 0 | 1,270 | 100 |
| 1 | (1) | 727 | 21 | 1,724 | 48 | 474 | 13 | 2,925 | 82 | 0 | 0 | 3,568 | 100 |
| 43,050 | 3 | 277,712 | 19 | 296,233 | 20 | 27,242 | 2 | 644,238 | 44 | 1,445 | (1) | 1,452,872 | 100 |

gions. Much of this will be available if needed for cultivated crops, although many farm operators will continue to use some for pasture and woodland. Obviously, the production of forage and wood products should be kept in balance with cultivated crop production and with other uses, such as wildlife and recreation.

Much of the 265 million acres of noncropland suitable for regular cultivation would require clearing, draining, or other land improvements to fit the soils for cultivation. Moreover, much of it is inconveniently located or occurs as small or irregular areas that cannot be used efficiently with modern machinery. Thus, it would not be economically feasible to bring all of these areas into cultivation.

**Class I land**

Class I land has few or no conditions that limit its use for most common agricultural crops; it can be safely cultivated without special conservation treatment (fig. 6).

The soils are suited to a wide range of plants and may be used safely for cultivated crops, pasture, range, woodland, and wildlife. They are nearly level and erosion hazard (wind or water) is low. They are deep, generally well drained, and easily worked. They hold water well and are either fairly well supplied with plant nutrients or highly responsive to fertilizer. These soils are not subject to damaging overflow. They are productive and suited for intensive cropping. The local climate is favorable for growing most common field crops. Class I land that is used for crops needs ordinary management practices to maintain it.

About 36.2 million acres or nearly 3 percent of the non-Federal rural land is in class I (table 1). Slightly more than 52 (50) percent of the class I land is in the Corn Belt, Northern Plains, and Southern Plains regions.

Seventy-six percent or 27.4 million acres of class I land is now used to produce cultivated crops (table 3); 11 percent, 3.9 million acres, is used for pasture and range; 10 percent, 3.6 million acres, for forest and woodland; and only 3 percent, 1.2 million acres, for other uses.

**Class II land**

Class II land has some natural conditions that require some conservation practice when it is cultivated or that limit the kinds of plants it can produce (fig. 7). Soils in class II require careful management, including conservation practices, to prevent deterioration or to improve air and water relations when the soils are cultivated. The limitations are few, however, and the practices are easy to apply. Although this land can be used for cultivated crops, pasture, range, woodland, wildlife food and cover, or outdoor recreation, the farm operator has less latitude in the choice of crops and management practices than with class I.

About 20 percent of the non-Federal rural land or 290.5 (290.1) million acres is in class II (table 1). The Corn Belt and Lake States regions have a high percentage of class II land; the Mountain and Pacific regions have little.

Two-thirds of the class II land or 192.9 (192.8) million acres is now being used as cropland (table 4). About equal amounts, 15 percent of the total in each case, are used for pasture and range and for forest and woodland. The acreages are 42.9 (42.8) and 43.4 (43.2) million acres respectively.

Four-fifths of the class II land in the Corn Belt and Northern Plains regions is cultivated, compared to less than half in the Southeast and Delta States regions.

TABLE 2.—*Use of land suitable for regular cultivation (classes I to III), 1958*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | Cropland | | Pasture and range | | Forest and woodland | | Other | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *1,000 acres* | *Per-cent* | *1,000 acres* | *Per-cent* | *1,000 acres* | *Per-cent* | *1,000 acres* | *Per-cent* | *1,000 acres* | *Per-cent* |
| Northeast | 16,963 | 44 | 4,014 | 10 | 14,216 | 36 | 4,000 | 10 | 39,193 | 100 |
| Lake States | 38,494 | 58 | 5,341 | 8 | 18,870 | 28 | 4,289 | 6 | 66,992 | 100 |
| Corn Belt | 84,191 | 76 | 12,637 | 11 | 8,990 | 8 | 5,759 | 5 | 111,578 | 100 |
| Northern Plains | 79,195 | 76 | 21,592 | 21 | 1,297 | 1 | 1,512 | 2 | 103,595 | 100 |
| Appalachian | 21,652 | 44 | 6,224 | 13 | 18,396 | 38 | 2,389 | 5 | 48,661 | 100 |
| Southeast | 17,848 | 33 | 6,703 | 12 | 25,532 | 47 | 4,082 | 8 | 54,165 | 100 |
| Delta States | 18,820 | 39 | 6,107 | 13 | 21,832 | 45 | 1,404 | 3 | 48,163 | 100 |
| Southern Plains | 48,141 | 51 | 33,624 | 36 | 11,246 | 12 | 1,187 | 1 | 94,198 | 100 |
| Mountain | 27,673 | 65 | 12,858 | 30 | 1,405 | 3 | 715 | 2 | 42,652 | 100 |
| Pacific | 20,132 | 72 | 4,225 | 15 | 2,519 | 9 | 1,023 | 4 | 27,898 | 100 |
| U.S. mainland | 373,110 | 59 | 113,323 | 18 | 124,301 | 19 | 26,360 | 4 | 637,094 | 100 |
| Alaska | 20 | 4 | 0 | 0 | 522 | 94 | 10 | 2 | 552 | 100 |
| Hawaii | 198 | 54 | 69 | 19 | 87 | 24 | 10 | 3 | 363 | 100 |
| U.S. total | 373,328 | 58 | 113,393 | 18 | 124,908 | 20 | 26,380 | 4 | 638,009 | 100 |

**Class III land**

Class III land has more serious or more numerous limitations on its use than class II land (table 1).

The soils are more restricted than those in classes I and II in the crops they can produce or, when cultivated, they call for conservation practices more difficult to install or to keep working efficiently. They may be used for cultivated crops, pasture, woodland, range, wildlife food and cover, or recreation.

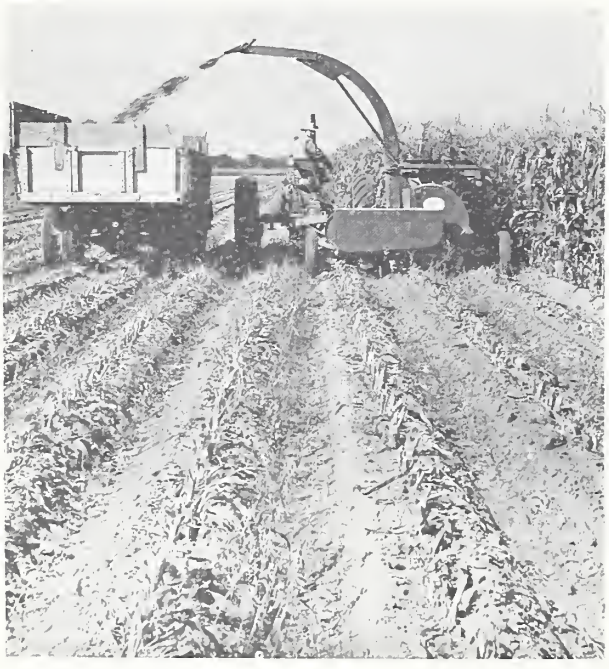

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*Figure 6.*—Class I. This nearly level fine sandy loam can be safely cultivated without special conservation treatment.

Limitations of soils in class III restrict the amount of clean cultivation; timing of planting, tillage, or harvesting; choice or yield of crops; or a combination of these. The limitations may be natural ones—such as steep slope, sandy or shallow soil, or too little or too much water—or the limitation may be the result of erosion brought on by the way the land has been used.

About 311.3 (310.8) million acres or 21.4 (21.5) percent of the non-Federal rural land is in class III (fig. 8). The percentage of class III land is high in the Delta States, Northern Plains, and Southeast regions.

About half of the class III land or 153.0 (152.9) million acres is used to produce cultivated crops (table 5). Twenty-one percent or 66.6 (66.5) million acres is used for pasture

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*Figure 7.*—Class IIe. Simple conservation practices such as contouring and stripcropping give adequate protection from erosion on Fayette soil of gentle slope.

TABLE 3.—*Use of class I land, 1958*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | Cropland | | Pasture and range | | Forest and woodland | | Other | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *1,000 acres* | *Per-cent* | *1,000 acres* | *Per-cent* | *1,000 acres* | *Per-cent* | *1,000 acres* | *Per-cent* | *1,000 acres* | *Per-cent* |
| Northeast | 1,188 | 64 | 131 | 7 | 395 | 21 | 147 | 8 | 1,861 | 100 |
| Lake States | 2,050 | 85 | 122 | 5 | 137 | 6 | 111 | 4 | 2,419 | 100 |
| Corn Belt | 6,062 | 79 | 578 | 8 | 622 | 8 | 393 | 5 | 7,656 | 100 |
| Northern Plains | 3,829 | 84 | 465 | 10 | 158 | 4 | 94 | 2 | 4,546 | 100 |
| Appalachian | 1,694 | 72 | 269 | 11 | 338 | 14 | 76 | 3 | 2,377 | 100 |
| Southeast | 1,585 | 68 | 236 | 10 | 400 | 17 | 102 | 5 | 2,323 | 100 |
| Delta States | 2,169 | 68 | 392 | 12 | 588 | 18 | 72 | 2 | 3,221 | 100 |
| Southern Plains | 4,451 | 66 | 1,345 | 20 | 837 | 13 | 63 | 1 | 6,696 | 100 |
| Mountain | 1,855 | 84 | 232 | 10 | 41 | 2 | 86 | 4 | 2,214 | 100 |
| Pacific | 2,534 | 88 | 168 | 6 | 55 | 2 | 103 | 4 | 2,860 | 100 |
| U.S. mainland | 27,418 | 76 | 3,939 | 11 | 3,570 | 10 | 1,247 | 3 | 36,174 | 100 |
| Alaska | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Hawaii | 18 | 86 | 1 | 5 | 2 | 9 | 0 | 0 | 21 | 100 |
| U.S. total | 27,435 | 76 | 3,940 | 11 | 3,572 | 10 | 1,247 | 3 | 36,195 | 100 |

TABLE 4.—*Use of class II land, 1958*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | Cropland | | Pasture and range | | Forest and woodland | | Other | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *1,000 acres* | *Per-cent* | *1,000 acres* | *Per-cent* | *1,000 acres* | *Per-cent* | *1,000 acres* | *Per-cent* | *1,000 acres* | *Per-cent* |
| Northeast | 9,076 | 50 | 1,659 | 9 | 5,620 | 31 | 1,751 | 10 | 18,103 | 100 |
| Lake States | 24,552 | 67 | 2,560 | 7 | 7,629 | 21 | 1,797 | 5 | 36,539 | 100 |
| Corn Belt | 52,333 | 80 | 5,771 | 9 | 3,885 | 6 | 3,036 | 5 | 65,025 | 100 |
| Northern Plains | 36,750 | 82 | 6,558 | 15 | 663 | 1 | 747 | 2 | 44,718 | 100 |
| Appalachian | 12,642 | 52 | 2,972 | 12 | 7,642 | 31 | 1,173 | 5 | 24,429 | 100 |
| Southeast | 9,584 | 47 | 2,562 | 13 | 7,152 | 35 | 1,077 | 5 | 20,376 | 100 |
| Delta States | 8,650 | 48 | 2,380 | 13 | 6,238 | 35 | 625 | 4 | 17,894 | 100 |
| Southern Plains | 22,187 | 54 | 15,161 | 37 | 3,416 | 8 | 454 | 1 | 41,218 | 100 |
| Mountain | 8,529 | 77 | 2,054 | 19 | 212 | 2 | 250 | 2 | 11,045 | 100 |
| Pacific | 8,504 | 79 | 1,161 | 11 | 702 | 7 | 364 | 3 | 10,731 | 100 |
| U.S. mainland | 192,808 | 66 | 42,837 | 15 | 43,158 | 15 | 11,275 | 4 | 290,077 | 100 |
| Alaska | 14 | 5 | 0 | 0 | 264 | 94 | 3 | 1 | 281 | 100 |
| Hawaii | 101 | 83 | 14 | 12 | 4 | 3 | 2 | 2 | 121 | 100 |
| U.S. total | 192,923 | 66 | 42,851 | 15 | 43,426 | 15 | 11,279 | 4 | 290,478 | 100 |

TABLE 5.—*Use of class III land, 1958*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | Cropland | | Pasture and range | | Forest and woodland | | Other | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *1,000 acres* | *Per-cent* | *1,000 acres* | *Per-cent* | *1,000 acres* | *Per-cent* | *1,000 acres* | *Per-cent* | *1,000 acres* | *Per-cent* |
| Northeast | 6,700 | 35 | 2,226 | 12 | 8,201 | 42 | 2,102 | 11 | 19,229 | 100 |
| Lake States | 11,892 | 42 | 2,658 | 10 | 11,104 | 40 | 2,380 | 8 | 28,034 | 100 |
| Corn Belt | 25,797 | 66 | 6,288 | 16 | 4,482 | 12 | 2,330 | 6 | 38,896 | 100 |
| Northern Plains | 38,616 | 71 | 14,569 | 27 | 476 | 1 | 671 | 1 | 54,331 | 100 |
| Appalachian | 7,316 | 33 | 2,983 | 14 | 10,415 | 48 | 1,140 | 5 | 21,855 | 100 |
| Southeast | 6,679 | 21 | 3,904 | 13 | 17,980 | 57 | 2,903 | 9 | 31,466 | 100 |
| Delta States | 8,000 | 30 | 3,334 | 12 | 15,007 | 55 | 708 | 3 | 27,049 | 100 |
| Southern Plains | 21,503 | 47 | 17,118 | 37 | 6,993 | 15 | 670 | 1 | 46,284 | 100 |
| Mountain | 17,289 | 59 | 10,572 | 36 | 1,153 | 4 | 379 | 1 | 29,393 | 100 |
| Pacific | 9,094 | 64 | 2,896 | 20 | 1,762 | 12 | 556 | 4 | 14,307 | 100 |
| U.S. mainland | 152,885 | 49 | 66,547 | 21 | 77,573 | 25 | 13,839 | 5 | 310,844 | 100 |
| Alaska | 6 | 2 | 0 | 0 | 257 | 95 | 7 | 3 | 271 | 100 |
| Hawaii | 79 | 36 | 54 | 24 | 80 | 36 | 8 | 4 | 221 | 100 |
| U.S. total | 152,970 | 49 | 66,602 | 21 | 77,910 | 25 | 13,854 | 5 | 311,335 | 100 |

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*Figure 8.*—**Class IIIe. Sloping soils in humid and subhumid regions require terracing and cover crops or other complex combinations of conservation treatments to control water erosion.**

and range; 25 percent or 77.9 (77.6) million acres for forest and woodland; and the remainder for other purposes.

More than 60 percent of the class III land in the Corn Belt, Northern Plains, and Pacific regions is used for crop production, compared to less than 35 percent in the Southeast, Delta States, and Appalachian regions.

## LAND SUITABLE FOR LIMITED CULTIVATION

### Class IV land

Class IV land is suitable for only occasional or limited cultivation (table 1, fig. 9).

Soils in class IV have very severe limitations that restrict the kinds of plants they can grow. When cultivated, they require very careful management, and conservation practices are more difficult to apply and maintain than on soils in classes II and III.

Class IV includes soils in areas where climate or overflow may preclude planting or harvesting crops during unfavorable years. Many sloping soils in class IV in humid areas are suited to occasional but not regular cultivation (fig. 10). Some of the poorly drained,

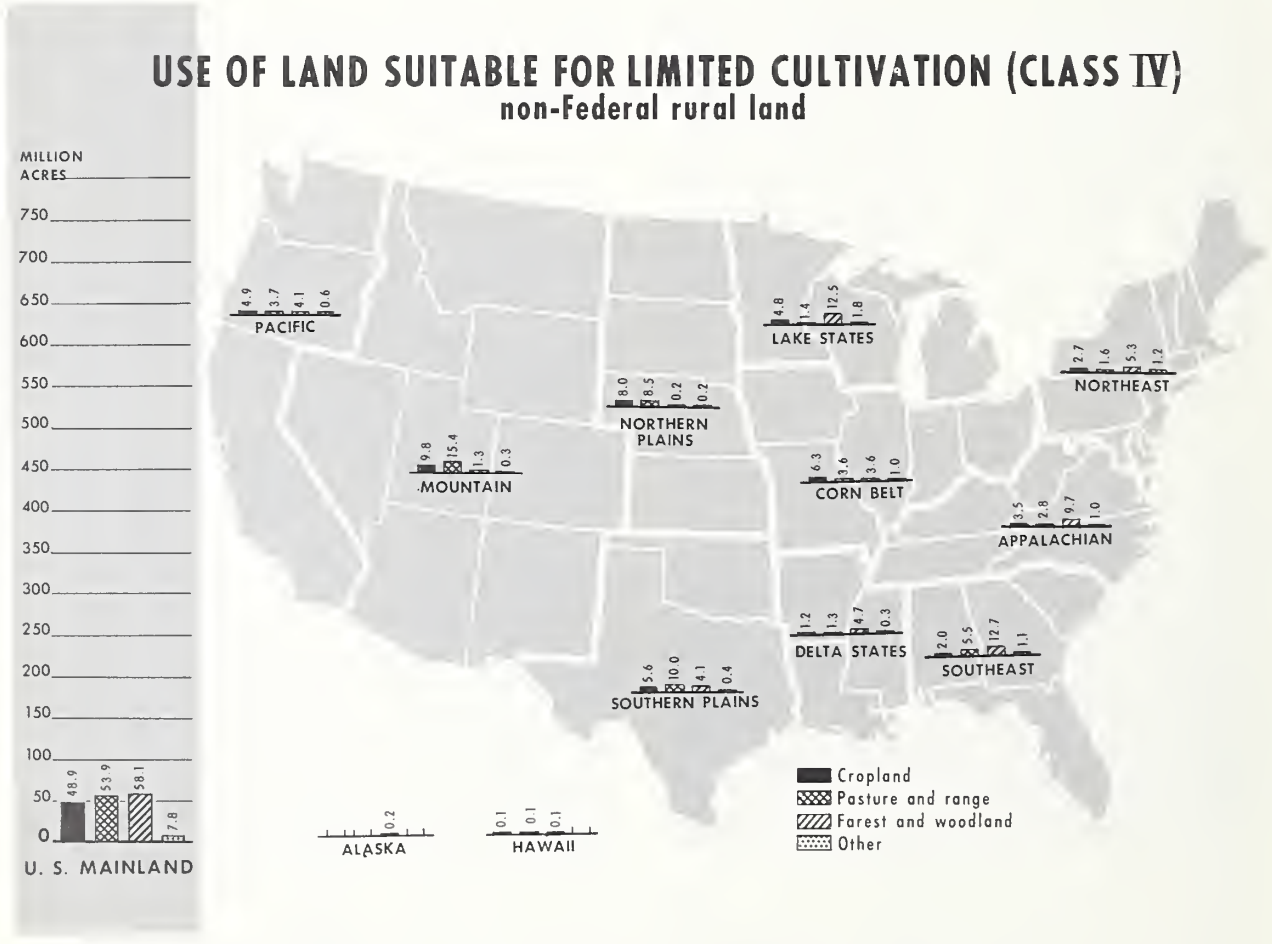


*Figure 9.*

nearly level soils are not subject to erosion but are poorly suited to some crops because of wetness, frequency of overflow, or low productivity for cultivated crops. Some soils in class IV are well suited to one or more special crops such as fruits and ornamental trees and shrubs.

In subhumid and semiarid areas, soils in class IV may produce good yields of adapted cultivated crops during years of above-average rainfall, low yields during years of average rainfall, and failures during years of below-average rainfall. Special treatments and practices are required to conserve moisture and maintain soil productivity and to prevent wind erosion.

About 169.2 (168.7) million acres or 11.6 (11.7) percent of the non-Federal rural land is class IV. The proportion of class IV land is high in the Southeast, the Lake States, and Appalachian regions. The Southern Plains, Northern Plains, and Mountain regions also have large acreages of this land (fig. 10).

This class of marginally arable soils is about equally divided among the major land uses (fig. 10). About a third is used for pasture and range, a third for forest and woodland, and slightly less than a third or 29 percent for cultivated crops (table 6). About 53.9 million acres is in pasture and range, 58.4 (58.1) million acres in forest and woodland, and 49.0 (48.9) million acres in cropland.

The percentage of class IV land being cultivated is highest in the Corn Belt and Northern Plains regions where about 45 percent is in cropland. In contrast, in the Southeast region only about 9 percent is being cultivated, and in the Delta States region only about 16 percent.

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***Figure 10.*—Class IVe. Sloping soils in humid areas are not safe for regular cultivation but may be used occasionally for clean-tilled crops or used to grow specialty crops such as grapes with special management practices.**

## LAND GENERALLY NOT SUITABLE FOR CULTIVATION

About 44 percent of the non-Federal rural land or 644.2 (640.8) million acres is generally not suitable for cultivation (classes V to VIII). The Northeast, Mountain, and Pacific regions have the highest proportions of this kind of land (fig. 11).

Almost half (49 percent) of this land is used for pasture and range, about two-fifths (42 percent) for forest and woodland, 4 percent for cropland, and 5 percent for other uses (table 7, fig. 11).

TABLE 6.—*Use of class IV land, 1958*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | Cropland | | Pasture and range | | Forest and woodland | | Other | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* |
| Northeast | 2,730 | 25 | 1,632 | 15 | 5,290 | 49 | 1,196 | 11 | 10,848 | 100 |
| Lake States | 4,847 | 24 | 1,418 | 7 | 12,466 | 60 | 1,848 | 9 | 20,579 | 100 |
| Corn Belt | 6,329 | 44 | 3,576 | 25 | 3,551 | 24 | 1,000 | 7 | 14,457 | 100 |
| Northern Plains | 8,021 | 48 | 8,503 | 50 | 188 | 1 | 158 | 1 | 16,870 | 100 |
| Appalachian | 3,536 | 21 | 2,845 | 16 | 9,700 | 57 | 975 | 6 | 17,057 | 100 |
| Southeast | 1,952 | 9 | 5,522 | 26 | 12,719 | 60 | 1,104 | 5 | 21,298 | 100 |
| Delta States | 1,203 | 16 | 1,271 | 17 | 4,736 | 63 | 281 | 4 | 7,491 | 100 |
| Southern Plains | 5,557 | 28 | 9,991 | 50 | 4,101 | 20 | 417 | 2 | 20,066 | 100 |
| Mountain | 9,836 | 37 | 15,370 | 57 | 1,299 | 5 | 275 | 1 | 26,779 | 100 |
| Pacific | 4,898 | 37 | 3,732 | 28 | 4,055 | 31 | 574 | 4 | 13,258 | 100 |
| U.S. mainland | 48,910 | 29 | 53,860 | 32 | 58,106 | 34 | 7,828 | 5 | 168,703 | 100 |
| Alaska | 2 | 1 | 1 | 1 | 193 | 97 | 2 | 1 | 199 | 100 |
| Hawaii | 81 | 29 | 77 | 27 | 114 | 41 | 8 | 3 | 280 | 100 |
| U.S. total | 48,993 | 29 | 53,938 | 32 | 58,413 | 34 | 7,838 | 5 | 169,181 | 100 |

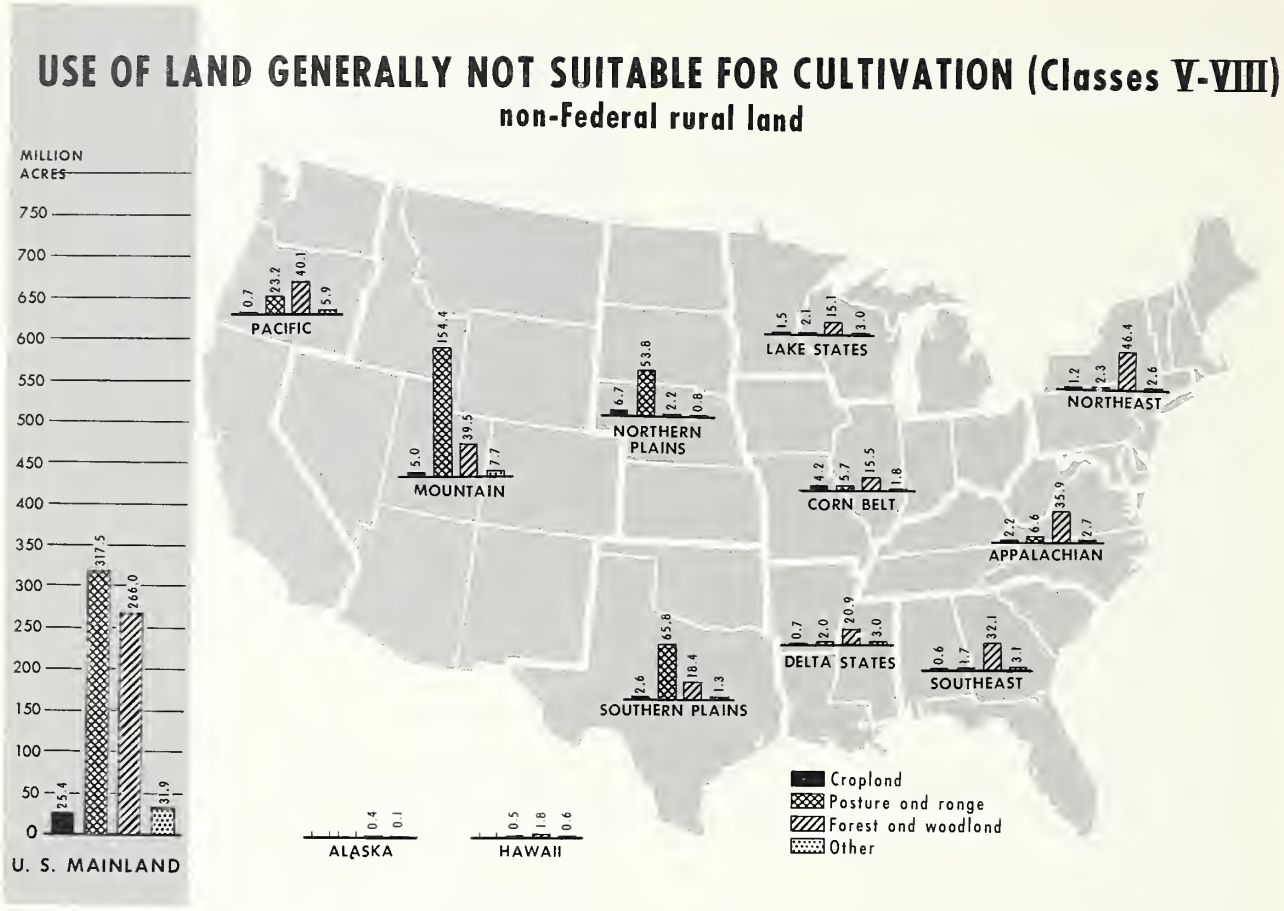


*Figure 11.*

TABLE 7.—*Use of land generally not suitable for cultivation (classes V to VIII), 1958*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | Cropland | | Pasture and range | | Forest and woodland | | Other | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* |
| Northeast | 1,214 | 2 | 2,345 | 5 | 46,404 | 88 | 2,613 | 5 | 52,576 | 100 |
| Lake States | 1,547 | 7 | 2,052 | 9 | 15,138 | 70 | 2,962 | 14 | 21,698 | 100 |
| Corn Belt | 4,207 | 15 | 5,721 | 21 | 15,537 | 57 | 1,773 | 7 | 27,238 | 100 |
| Northern Plains | 6,680 | 11 | 53,808 | 85 | 2,187 | 3 | 797 | 1 | 63,472 | 100 |
| Appalachian | 2,174 | 5 | 6,584 | 14 | 35,900 | 76 | 2,653 | 5 | 47,310 | 100 |
| Southeast | 584 | 2 | 1,705 | 4 | 32,051 | 86 | 3,114 | 8 | 37,454 | 100 |
| Delta States | 694 | 3 | 1,948 | 7 | 20,850 | 79 | 3,028 | 11 | 26,520 | 100 |
| Southern Plains | 2,554 | 3 | 65,833 | 75 | 18,390 | 21 | 1,342 | 1 | 88,117 | 100 |
| Mountain | 4,980 | 2 | 154,355 | 75 | 39,461 | 19 | 7,689 | 4 | 206,485 | 100 |
| Pacific | 746 | 1 | 23,174 | 33 | 40,073 | 57 | 5,932 | 9 | 69,925 | 100 |
| U.S. mainland | 25,378 | 4 | 317,525 | 50 | 265,991 | 41 | 31,903 | 5 | 640,796 | 100 |
| Alaska | 1 | (1) | 1 | (1) | 384 | 74 | 134 | 26 | 519 | 100 |
| Hawaii | 36 | 1 | 500 | 17 | 1,781 | 61 | 608 | 21 | 2,925 | 100 |
| U.S. total | 25,415 | 4 | 318,026 | 49 | 268,155 | 42 | 32,645 | 5 | 644,238 | 100 |

[1] Less than 0.5 percent.

Most of the 4 percent or more than 25 million acres now being used for cropland should be shifted into other uses, although under special management some can be used safely for cropland. More than half of this cropland is in three regions—the Northern Plains, Corn Belt, and Mountain.

This problem acreage makes up 1.7 percent of the total non-Federal rural land. In contrast, it makes up 2.4 percent of the Great Plains (Northern Plains and Southern Plains regions combined) or 9.2 million acres. West of the Plains such cropland makes up less than 1 percent of the area and eastward it makes up about 1.5 percent.

Progress is being made in shifting unsuitable cropland to other uses. During the last 5 years in the United States, cropland of all classes has been converted to grass at the rate of 2 to 2½ million acres per year. An additional ⅓ to ½ million acres has been converted annually to trees and shrubs. CNI Committees in Kansas estimated that about 1 million acres of class VI cropland in that State would be converted to grassland by 1975.

### Class V land

Class V land has some condition that limits its use largely to pasture or range, woodland, recreation, watershed protection, or wildlife habitat, but it has no erosion hazard (table 1).

The soils have limitations that restrict the kind of plants that can be grown or that prevent normal tillage of cultivated crops. They are nearly level but they are wet (fig. 12), are frequently overflowed by streams, are stony, have climatic limitations, or have some combination of these limitations.

About 43 million acres or 3 percent of the non-Federal rural land is in class V. It is concentrated especially in the Southeast and Delta States regions.

FLA-D1-105

*Figure 12.*—**ClassVw. Level Grady sandy loam with no erosion hazard is too wet for cultivation but can be used for pasture.**

Two-thirds of all the class V land in the United States or 28.9 million acres is now being used for forest and woodland, and one-fourth or 10.5 million acres for pasture and range (table 8). Only 4 percent or 1.8 million acres is used for cropland, and the remainder, also 4 percent, for other uses.

### Class VI land

Class VI land has severe limitations that make it generally unsuited for cultivation and restrict its use largely to pasture, range, woodland, recreation, watershed protection, or wildlife habitat (fig. 13). It may be well or poorly

TABLE 8.—*Use of class V land, 1958*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | Cropland | | Pasture and range | | Forest and woodland | | Other | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* |
| Northeast | 3 | 3 | 12 | 10 | 94 | 77 | 13 | 10 | 122 | 100 |
| Lake States | 167 | 3 | 547 | 10 | 4,091 | 74 | 733 | 13 | 5,538 | 100 |
| Corn Belt | 263 | 19 | 511 | 36 | 484 | 34 | 154 | 11 | 1,412 | 100 |
| Northern Plains | 318 | 13 | 2,063 | 83 | 95 | 4 | 12 | (1) | 2,488 | 100 |
| Appalachian | 35 | 6 | 50 | 9 | 473 | 83 | 10 | 2 | 568 | 100 |
| Southeast | 101 | 1 | 804 | 6 | 11,626 | 88 | 638 | 5 | 13,169 | 100 |
| Delta States | 139 | 2 | 575 | 7 | 7,848 | 90 | 118 | 1 | 8,680 | 100 |
| Southern Plains | 622 | 7 | 5,007 | 53 | 3,676 | 39 | 124 | 1 | 9,429 | 100 |
| Mountain | 109 | 10 | 833 | 73 | 170 | 15 | 25 | 2 | 1,137 | 100 |
| Pacific | 16 | 3 | 123 | 24 | 364 | 72 | 4 | 1 | 507 | 100 |
| U.S. mainland | 1,773 | 4 | 10,524 | 25 | 28,920 | 67 | 1,832 | 4 | 43,050 | 100 |
| Alaska | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Hawaii | 0 | 0 | 1 | (1) | 0 | 0 | 0 | 0 | 1 | (1) |
| U.S. total | 1,773 | 4 | 10,525 | 25 | 28,920 | 67 | 1,832 | 4 | 43,050 | 100 |

[1] Less than 0.5 percent.

PA-10087

*Figure 13.*—**Class VIe. Steep slopes make some soils in humid areas unsafe for cultivation. These hillside fields have been planted to trees.**

suited to woodland, depending on the character of the local climate and soils.

The soils are such that it is practical to apply range or pasture improvements such as seeding, liming, fertilizing, or water control by means of contour furrows, drainage ditches, diversions, or water spreaders.

Some soils in class VI can be used safely for the common crops if unusually intensive management is used. Some are also adapted to long-term meadows and sodded orchards that do not require cultivation and to special crops such as blueberries that require soil conditions unlike those demanded by the common crops.

About 277.7 (276.8) million acres or 19.1 percent of the non-Federal rural land is in class VI (table 1). The proportion of class VI land is large in the Mountain, Pacific, Northeast, and Great Plains regions.

Three-fifths of the class VI land or 166.3 (166.1) million acres is being used for pasture and range; 32 percent or 88.5 (87.9) million acres, for forest and woodland; 6 percent or 17.9 million acres, for cropland; and 2 percent or 5.0 (4.9) million acres, for other uses (table 9).

About 70 percent or 12.4 million acres of the class VI land being cultivated is in the Northern Plains, Mountain, and Corn Belt regions. Most of the class VI land in these regions, however, is used for pasture and range.

In the Northeast, Southeast, Lake States, Appalachian , Delta States, and Pacific regions this land is used mainly for forest and woodland.

### Class VII land

Class VII land has very severe limitations that make it unsuited for cultivation and restrict its use to pasture or range, woodland, recreation, watershed protection, or wildlife habitat (figs. 14 and 15). In these uses the soils require careful management.

Soils in this class have restrictions more severe than those in class VI because of one or more continuing limitations that cannot be corrected. These conditions make them unsuited for common cultivated crops, although some may be used for special crops under unusual management practices. Physical conditions of the soils make it impractical to apply such pasture or range improvements as seeding, liming, or fertilizing, and such water control measures as contour furrows, ditches, diversions, or water spreaders. Soils in this class may be well or poorly suited to woodland.

About 296.2 (294.2) million acres or 20.4 (20.3) percent of non-Federal rural land is in class VII (table 1). Class VII land is especially prevalent in the Mountain, Pacific, Ap-

TABLE 9.—*Use of class VI land, 1958*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | Cropland | | Pasture and range | | Forest and woodland | | Other | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* |
| Northeast | 917 | 4 | 1,623 | 6 | 23,196 | 87 | 869 | 3 | 26,605 | 100 |
| Lake States | 744 | 17 | 717 | 16 | 2,573 | 59 | 347 | 8 | 4,380 | 100 |
| Corn Belt | 2,401 | 27 | 2,653 | 30 | 3,275 | 36 | 641 | 7 | 8,970 | 100 |
| Northern Plains | 5,903 | 16 | 29,804 | 80 | 1,177 | 3 | 258 | 1 | 37,142 | 100 |
| Appalachian | 1,576 | 11 | 3,419 | 24 | 8,217 | 59 | 854 | 6 | 14,067 | 100 |
| Southeast | 321 | 4 | 464 | 6 | 6,210 | 80 | 773 | 10 | 7,768 | 100 |
| Delta States | 274 | 8 | 349 | 9 | 3,012 | 80 | 120 | 3 | 3,755 | 100 |
| Southern Plains | 992 | 3 | 31,076 | 83 | 4,915 | 13 | 295 | 1 | 37,278 | 100 |
| Mountain | 4,113 | 4 | 82,652 | 81 | 15,079 | 15 | 468 | (1) | 102,312 | 100 |
| Pacific | 663 | 2 | 13,304 | 38 | 20,287 | 59 | 280 | (1) | 34,533 | 100 |
| U.S. mainland | 17,905 | 6 | 166,061 | 60 | 87,941 | 32 | 4,904 | 2 | 276,810 | 100 |
| Alaska | 1 | (1) | 0 | 0 | 142 | 81 | 34 | 19 | 176 | 100 |
| Hawaii | 34 | 5 | 227 | 31 | 408 | 56 | 57 | 8 | 727 | 100 |
| U.S. total | 17,940 | 6 | 166,288 | 60 | 88,490 | 32 | 4,995 | 2 | 277,712 | 100 |

[1] Less than 0.5 percent.

NY-812

*Figure 14.*—**Class VIIe. This severely eroded hillside field is unsuitable for cultivation and is severely restricted in its use for pasture or woodland.**

MONT-322

*Figure 15.*—**Class VIIs. Shallow rocky soils are unsuitable for cultivation and have severe limitations for grazing or forestry.**

palachian, Northeast, and Great Plains regions.

Slightly less than half of the total area or 144.2 (142.7) million acres is used for forest and woodand, and a nearly equal amount or 138.7 (138.4) million acres for pasture and range (table 10). Only 2 percent or 5.6 million acres is in cropland, and 2 percent or 7.7 (7.5) million acres in other uses.

### Class VIII land

Class VIII land has limitations that prevent its use for commercial plant production (table 1). If given careful protection, it can be used for recreation, watershed protection, or wildlife habitat.

Soils and landforms in class VIII cannot be expected to return significant on-site benefits from management for crops, grasses, or trees, although benefits from wildlife use, watershed protection, or recreation may be possible (fig. 16). Badlands, rock outcrop, sandy beaches, river wash, mire tailings, and other nearly barren areas are included in class VIII (fig. 17). With major reclamation, a few areas of class VIII land can be altered to make them suited to cropland use.

Slightly less than 2 percent of the non-Federal rural land or 27.2 (26.7) million acres is in class VIII. The largest acreages are in the Pacific, Mountain, and Delta States regions.

TABLE 10.—*Use of class VII land, 1958*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | Cropland | | Pasture and range | | Forest and woodland | | Other | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* |
| Northeast | 280 | 1 | 647 | 3 | 21,670 | 92 | 827 | 4 | 23,423 | 100 |
| Lake States | 624 | 6 | 739 | 8 | 7,832 | 81 | 466 | 5 | 9,661 | 100 |
| Corn Belt | 1,519 | 9 | 2,531 | 15 | 11,716 | 70 | 898 | 6 | 16,663 | 100 |
| Northern Plains | 458 | 2 | 21,902 | 94 | 896 | 4 | 58 | (1) | 23,314 | 100 |
| Appalachian | 560 | 2 | 3,110 | 10 | 27,120 | 85 | 1,176 | 3 | 31,966 | 100 |
| Southeast | 160 | 1 | 409 | 3 | 13,923 | 90 | 886 | 6 | 15,379 | 100 |
| Delta States | 281 | 2 | 1,023 | 9 | 9,990 | 85 | 424 | 4 | 11,718 | 100 |
| Southern Plains | 938 | 2 | 29,747 | 72 | 9,798 | 24 | 901 | 2 | 41,384 | 100 |
| Mountain | 748 | 1 | 68,991 | 74 | 22,889 | 24 | 619 | 1 | 93,247 | 100 |
| Pacific | 65 | (1) | 9,325 | 34 | 16,853 | 61 | 1,214 | 5 | 27,456 | 100 |
| U.S. mainland | 5,634 | 2 | 138,422 | 47 | 142,687 | 48 | 7,469 | 3 | 294,211 | 100 |
| Alaska | 0 | 0 | 0 | 0 | 212 | 71 | 86 | 29 | 299 | 100 |
| Hawaii | 1 | (1) | 268 | 16 | 1,329 | 77 | 126 | 7 | 1,724 | 100 |
| U.S. total | 5,636 | 2 | 138,690 | 47 | 144,227 | 49 | 7,682 | 2 | 296,233 | 100 |

[1] Less than 0.5 percent.

PA-100209

*Figure 16.*—Class VIIIw. Marshlands that are impractical to drain and useless for grazing may have important values as wildlife habitat.

ARIZ-4924

*Figure 17.*—Class VIIIs. Badlands and other unproductive landforms are included in class VIII.

About two-thirds of the class VIII land or 18.1 (17.7) million acres is being used within its capability (table 11). About 24 percent or 6.5 (6.4) million acres, however, is in forest and woodland and 9 percent or 2.5 million acres in pasture and range. A very small acreage is in cropland.

## MAJOR CONSERVATION PROBLEMS

In addition to land-capability classes, the CNI indicates the major conservation problems by grouping soils into four land-capability subclasses on the basis of their dominant limitations for agricultural use (fig. 18).

Some soils are subject to erosion if they are not protected, while others are naturally wet and must be artificially drained if cultivated crops are to be grown. Some soils are shallow or droughty or have other soil deficiencies. Still others are in areas where climate limits their use. The four subclasses indicate which of these is most serious: Erosion hazards, designated by the symbol "e"; excess water, either in or on the surface, "w"; unfavorable soil conditions in the root zone, "s"; and adverse climate, "c." The land-capability class and subclass together provide information about both the degree and the kind of limitation. There are, of course, no subclasses in class I.

The grouping of soils into subclasses is broad. Since all soils are placed in only four

TABLE 11.—*Use of class VIII land, 1958*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | Cropland | | Pasture and range | | Forest and woodland | | Other | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* |
| Northeast | 14 | 1 | 64 | 3 | 1,444 | 59 | 904 | 37 | 2,426 | 100 |
| Lake States | 12 | 1 | 50 | 2 | 642 | 30 | 1,416 | 67 | 2,120 | 100 |
| Corn Belt | 24 | 13 | 27 | 14 | 62 | 32 | 80 | 41 | 194 | 100 |
| Northern Plains | 1 | (1) | 39 | 7 | 19 | 4 | 468 | 89 | 528 | 100 |
| Appalachian | 2 | (1) | 5 | 1 | 90 | 13 | 612 | 86 | 709 | 100 |
| Southeast | 2 | (1) | 28 | 2 | 292 | 26 | 817 | 72 | 1,139 | 100 |
| Delta States | 0 | 0 | 0 | 0 | 0 | 0 | 2,367 | 100 | 2,367 | 100 |
| Southern Plains | 0 | 0 | 3 | 11 | 1 | 4 | 22 | 85 | 26 | 100 |
| Mountain | 9 | (1) | 1,879 | 19 | 1,324 | 14 | 6,576 | 67 | 9,788 | 100 |
| Pacific | 1 | (1) | 423 | 6 | 2,570 | 34 | 4,434 | 60 | 7,429 | 100 |
| U.S. mainland | 66 | (1) | 2,518 | 10 | 6,443 | 24 | 17,697 | 66 | 26,725 | 100 |
| Alaska | 0 | 0 | 0 | 0 | 30 | 68 | 14 | 32 | 44 | 100 |
| Hawaii | 0 | 0 | 4 | 1 | 45 | 9 | 425 | 90 | 474 | 100 |
| U.S. total | 66 | (1) | 2,523 | 9 | 6,518 | 24 | 18,136 | 67 | 27,242 | 100 |

[1] Less than 0.5 percent.

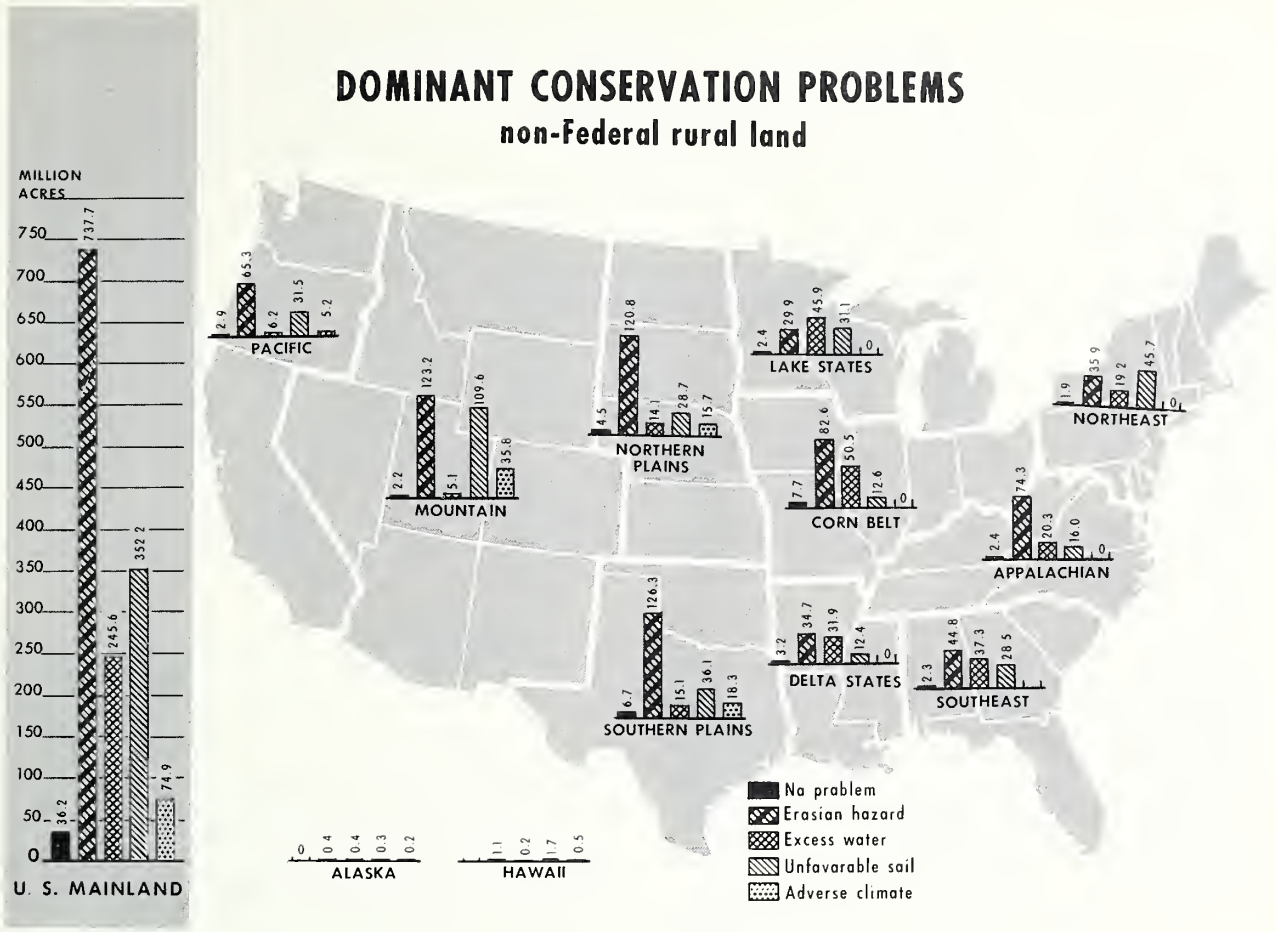


*Figure 18.*

groups, each subclass obviously includes a wide range of characteristics and properties. Soils in subclass s, for example, may be shallow, stony, or sandy, or they may be saline or sodic. Moreover, in addition to the dominant problem of the unfavorable soil condition in the root zone, they may be subject to erosion or affected by excess water.

Likewise, soils in subclass e, in addition to being sloping and subject to erosion, may have some unfavorable soil condition in the root zone, such as dense compact subsoils or rock near the surface. Soil characteristics and qualities influence the use and management of a soil regardless of the subclass used to characterize its dominant conservation problem.

Some level, wet soils placed in subclass w may have a dense subsoil (claypan) while others may have a permeable subsoil. The permeable soils may be wet because of a high water table. Soils with the claypan may have a soil problem, but they are placed in subclass w because wetness is the dominant limitation to use.

In some instances, it is difficult to determine the dominant conservation problem. For example, should a sloping soil that has a wetness problem be placed in w or e subclass? Where two kinds of limitation that can be modified or corrected are essentially equal, the subclasses have the priority: e, w, and s.

Limitations imposed by erosion (e); excess water (w); and shallow soils, stones, low moisture-holding capacity, salinity, or sodium (s) can be modified or partially overcome and take precedence over climate (subclass c) in determining subclasses in the land-capability classification.

For example, in humid regions soils that have equal problems of erosion and excess water are placed in subclass e; soils having equal problems of excess water and root-zone limitation are placed in subclass w. In grouping soils of subhumid and semiarid regions that have both an erosion hazard and a climatic limitation, subclass e takes precedence over subclass c, and in grouping soils with both root-zone limitations and climatic limitations, subclass s takes precedence over subclass c.

Though the land-capability subclasses pro-

TABLE 12.—*Dominant conservation problems (land-*

[Because of rounding, some totals may not equal the sum of the

| Region | No problem Class I | | Erosion hazard (subclass e) | | | | | Excess water (subclass w) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Class II-III | Class IV | Class V-VIII | Total | | Class II-III | Class IV | Class V-VIII | Total | |
| | *1,000 acres* | *Percent* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *Percent* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *Percent* |
| Northeast | 1,861 | 2 | 21,417 | 5,867 | 8,593 | 35,877 | 35 | 11,103 | 2,993 | 5,064 | 19,160 | 19 |
| Lake States | 2,419 | 2 | 22,936 | 3,327 | 3,640 | 29,903 | 28 | 29,742 | 7,665 | 8,458 | 45,865 | 42 |
| Corn Belt | 7,656 | 5 | 51,364 | 13,048 | 18,178 | 82,590 | 54 | 48,580 | 317 | 1,568 | 50,465 | 33 |
| Northern Plains | 4,546 | 2 | 65,240 | 10,459 | 45,134 | 120,833 | 66 | 8,318 | 1,696 | 4,096 | 14,110 | 8 |
| Appalachian | 2,377 | 2 | 28,882 | 10,999 | 34,426 | 74,307 | 66 | 13,753 | 4,420 | 2,142 | 20,315 | 18 |
| Southeast | 2,323 | 2 | 21,747 | 7,254 | 15,763 | 44,764 | 40 | 14,737 | 5,743 | 16,830 | 37,310 | 33 |
| Delta States | 3,221 | 4 | 19,253 | 4,077 | 11,342 | 34,672 | 42 | 22,131 | 1,662 | 8,089 | 31,882 | 39 |
| Southern Plains | 6,696 | 3 | 59,238 | 18,530 | 48,506 | 126,274 | 62 | 6,249 | 1,056 | 7,786 | 15,091 | 8 |
| Mountain | 2,214 | 1 | 25,417 | 15,252 | 82,504 | 123,173 | 44 | 1,578 | 712 | 2,848 | 5,138 | 2 |
| Pacific | 2,860 | 2 | 12,242 | 7,070 | 46,031 | 65,343 | 59 | 3,897 | 1,273 | 1,055 | 6,225 | 6 |
| U.S. mainland | 36,174 | 3 | 327,736 | 95,883 | 314,116 | 737,735 | 51 | 160,089 | 27,536 | 57,938 | 245,563 | 17 |
| Alaska | 0 | 0 | 209 | 66 | 168 | 443 | 35 | 80 | 86 | 261 | 427 | 33 |
| Hawaii | 21 | 1 | 266 | 166 | 672 | 1,104 | 31 | 24 | 13 | 205 | 242 | 7 |
| U.S. total | 36,195 | 3 | 328,210 | 96,115 | 314,956 | 739,281 | 51 | 160,192 | 27,636 | 58,403 | 246,232 | 17 |

[1] Less than 0.5 percent.

vide general information on the four broad kinds of conservation problems, they do not indicate the specific kinds of management required. This information is provided by the more detailed category of the classification—the capability unit. Summaries at this degree of detail have not been made in this report, but the local data are available in every State and can be summarized for a specific use.

The degree of magnitude of the conservation problem is shown by the class designation that accompanies the problem designation. For example, a soil classified as class IVw has a greater limitation in use than one classified as class IIw and the task of overcoming the wetness would be correspondingly more difficult. The cost of drainage, however, is not necessarily greater for the soils in class IV than for those in class IIw. Differences in initial costs of the protective or development systems do not influence the land classification.

The fact that certain wet soils are in classes II, III, and IV does not imply that they should be drained; but the class does indicate the degree of their continuing limitation in use or risk of soil damage, or both, if they were to be drained. Where it is not feasible to improve soils by drainage, irrigation, removal of stones, or removal of excess salts or exchangeable sodium, or to protect them from overflow, they are classified according to present limitations in use.

Soils already drained or irrigated are grouped according to the continuing soil and climatic limitations and risks that affect their use under the present systems or feasible improvements in them.

Land-capability classes and subclasses are broad general summaries of soil characteristics from which only general conclusions can be drawn. Although this information can be very helpful for broad planning, it is not adequate for planning local areas. Planning for these must be based on accurate information about the land-capability units of those areas.

All but 3 percent of the non-Federal rural land is characterized by the dominance of one or another of the four major conservation problems that limit land capability. In other words, the 36.2 million acres of class I land does not have any of these problems. The other 1,415.2 (1,410.4) million acres is classified in one of the four land-capability subclasses explained in the preceding section (fig. 18). As previously mentioned, land in any subclass may have other problems of equal or secondary importance.

The prevalence of the different problems varies widely from region to region (table 12).

**Erosion**

Erosion susceptibility and past erosion damage are the major factors that place soils in subclass e (fig. 19). These soils may also have a secondary problem of excess water or unfavorable soil condition in the root zone or a climatic limitation.

About 51 percent of the non-Federal rural land of the United States or 739.3 (737.7) million acres is in land-capability subclass e (table 12).

The erosion hazard is especially serious in the Northern Plains, Southern Plains, and Appalachian regions (fig. 18).

In the Lake States, Corn Belt, and Northern Plains regions slightly more than one-half of the land with a dominant erosion problem is used for cultivated crops, compared to about

*capability subclasses) on non-Federal rural land, 1958*

items listed and data may not check exactly with summary tables]

| Unfavorable soil (subclass s) | | | | | Adverse climate (subclass c) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Class II-III | Class IV | Class V-VIII | Total | | Class II-III | Class IV | Class V-VIII | Total | | Total | |
| *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *Percent* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* |
| 4,812 | 1,988 | 38,918 | 45,718 | 44 | 0 | 0 | 0 | 0 | 0 | 102,616 | 100 |
| 11,894 | 9,587 | 9,601 | 31,082 | 28 | 0 | 0 | 0 | 0 | 0 | 109,269 | 100 |
| 3,977 | 1,092 | 7,492 | 12,561 | 8 | 0 | 0 | 0 | 0 | 0 | 153,272 | 100 |
| 9,782 | 4,694 | 14,242 | 28,718 | 15 | 15,708 | 21 | 0 | 15,729 | 9 | 183,936 | 100 |
| 3,648 | 1,638 | 10,743 | 16,029 | 14 | 0 | 0 | 0 | 0 | 0 | 113,028 | 100 |
| 15,352 | 8,301 | 4,860 | 28,513 | 25 | 6 | 0 | 1 | 7 | (1) | 112,917 | 100 |
| 3,559 | 1,752 | 7,090 | 12,401 | 15 | 0 | 0 | 0 | 0 | 0 | 82,176 | 100 |
| 10,633 | 479 | 24,942 | 36,054 | 18 | 11,382 | 0 | 6,883 | 18,265 | 9 | 202,380 | 100 |
| 8,944 | 6,888 | 93,805 | 109,637 | 40 | 4,498 | 3,928 | 27,328 | 35,754 | 13 | 275,916 | 100 |
| 8,698 | 4,689 | 18,081 | 31,468 | 28 | 201 | 227 | 4,758 | 5,186 | 5 | 111,082 | 100 |
| 81,300 | 41,108 | 229,771 | 352,179 | 24 | 31,796 | 4,176 | 38,970 | 74,942 | 5 | 1,446,593 | 100 |
| 113 | 46 | 91 | 250 | 20 | 150 | 0 | 0 | 150 | 12 | 1,270 | 100 |
| 14 | 65 | 1,639 | 1,718 | 48 | 39 | 35 | 409 | 483 | 14 | 3,568 | 100 |
| 81,427 | 41,219 | 231,501 | 354,147 | 24 | 31,985 | 4,211 | 39,379 | 75,575 | 5 | 1,451,430 | 100 |

one-fifth to one-fourth in the Southeast, Delta States, Southern Plains, Mountain, and Pacific regions

**Excess water**

Poor internal soil drainage, wetness, high water table, and overflow are the conditions that place soils in subclass w (fig. 20). These soils may also have secondary problems of erosion hazard, unfavorable soil conditions in the root zone, or climatic limitations.

About 17 percent or 246.2 (245.6) million acres of the soils are in subclass w (table 12). The Lake States, Corn Belt, Delta States, and Southeast regions have the major concentrations of soils in this subclass (fig. 18).

About three-fourths of subclass w is suitable for cultivation. The fact that these soils are in class II, III, and IV, however, does not mean that they should be drained. The decision must be based on circumstances that apply to the individual farm or ranch.

Only a small part—less than one-tenth—of the Northern Plains, Southern Plains, Mountain, and Pacific regions has a major problem of excess water.

**Unfavorable soil**

Characteristics of the root zone that place soils in subclass s include shallow soils (fig. 21), stoniness, low moisture-holding capacity, low fertility difficult to correct, and salinity or

N.MEX-78348

***Figure 19.*—Subclass e. Erosion by wind is the dominant hazard on much of the land in the semiarid Plains.**

NEB-1224

***Figure 20.*—Subclass w. The hazard of overflow or other forms of excess water in the soil are major limitations on the use of land in subclass w.**

KAN-1906

*Figure 21.*—Subclass s. Shallowness of soil to rock limits the capability of many soils in mountainous and arid areas.

AA-229

*Figure 23.*—Subclass c. In high mountain areas of Alaska, and in parts of the Northeast and Lake States, low temperature and short growing season are dominant limitations on land capability.

sodium (fig. 22). These soils may also have secondary problems of erosion hazard, excess water, or climatic limitations.

About 24 percent or 354.1 (352.2) million acres of the soils are in subclass s (table 12). About one-third of these are in classes II, III, and IV and are suitable for regular or limited cultivation. They are especially prevalent in the Northeast and Mountain regions (fig. 18).

**Adverse climate**

Adverse climate (lack of moisture or low temperature and short growing season) is the dominant limitation to capability of soils in subclass c (fig. 23). Some of these soils have erosion hazard, excess water hazard, or root-zone limitation as secondary problems.

CAL-7220

*Figure 22.*—Subclass s. Soluble salts in the root zone limit the capability of some soils, such as these light-colored spots of Traver loam.

Since the limitations that can be modified or corrected (erosion, excess water, and unfavorable soil) take precedence over climate in determining subclasses, only 5 percent or 75.6 (74.9) million acres is in this subclass. Most of it is in the Northern Plains, Southern Plains, Mountain, and Pacific regions.

## *Land Use*

The 48 States in the U.S. mainland total 1,902 million acres. The addition of Alaska and Hawaii as States extended this area to a little more than 2,271 million acres of land and more than 42 million acres of water area, making a total of 2,313 million acres.

This broad expanse is made up of many different kinds of land. Climate, depth and character of soil, slope of surface, and development of land all vary widely in the different regions. The preceding section detailed the major characteristics and agricultural capabilities of the Nation's non-Federal rural land.

How is this land used? Will the same use suffice 15 to 20 years from now, when our increasing population will need more of the products produced by the soil? This section of the report considers these questions.

### HOW THE LAND IS USED

Nationally, the land use pattern has been gradually changing. Since the 1920's acreage used for cropland and for pasture and range has been decreasing while that used for forest and woodland has remained relatively constant. Recently, urban and built-up areas have increased rapidly. In addition, there have been marked shifts within the agricultural plant

that did not result in net changes in the acreage devoted to each land use. A large acreage of cropland, less desirable for cultivation because of topography, climatic conditions, erosion, or low fertility, has reverted to grassland or forest. A somewhat smaller acreage of the better soils in grassland and forest has been converted to cropland, often because of irrigation or drainage developments.

About 81 percent of the total land area of the United States is now used in direct agricultural production, including forestry and grazing. The remaining 19 percent is used for urban and other built-up areas, recreation, wildlife, public facilities, and miscellaneous other purposes (U.S. Census, 1962).

Land used for agriculture in the United States customarily is divided into two broad classes: (1) land in farms and ranches; and (2) land not in farms and ranches. Most of the private, Indian, State, and local Government land used for agriculture is included in farms and ranches. The Federal land generally is used for special purposes, or, if used for grazing, is generally used by permit in common and not as part of a farm or ranch. Some of the private timberland, especially that held by lumber plants, pulp mills, and other industries, is not in farms or ranches.

The Conservation Needs Inventory (CNI), like farmland in the foregoing classification, included the private, Indian, State, and local Government land used for agriculture, and excluded the Federal land except for the small acreage of cultivated cropland. The Inventory for the 50 States including Alaska and Hawaii accounted for 1,452.9 million acres of rural land (1,448.0 million acres in the 48 mainland States). In addition, urban and built-up areas made up 50.8 (50.7) million acres; farm ponds, small reservoirs, and other small water areas, 6.9 million acres; and Federal land 761.3 (396.2) million acres. Together, these make a total land area of 2,271.3 (1,901.8) million acres (fig. 24, table 13).

The total cropland[3] acreage was estimated at 447.7 (447.4) million acres or 31 percent of the total acreage included in the Inventory; grassland pasture and range, 485.4 (484.7) million acres or 33 percent; forest and woodland, 452.7 (449.7) million acres or 31 percent; and miscellaneous other land, 67.0 (66.3) million acres or 5 percent (fig. 25, table 14).

In addition to the acreage shown as cropland about 2.7 million acres of the pasture and range acreage in Kentucky and Tennessee is infrequently broken out of pasture for grain or other crops. Inclusion of this acreage in cropland would have given a total of more than 450 million acres, instead of the 447.7 million acres shown in the tables in this report.

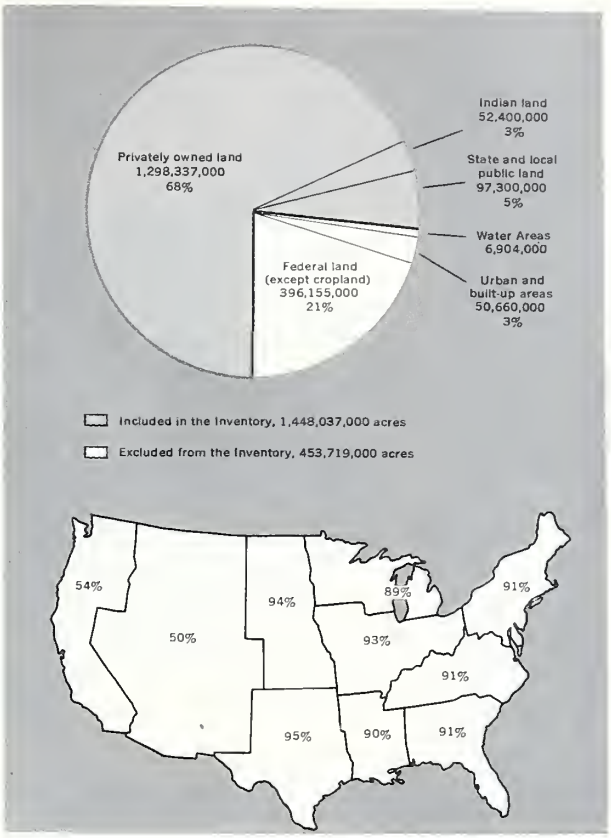


*Figure 24.*—**Land included in the Inventory (top) and agricultural land in the United States (bottom).**

In Texas about 4.3 million acres included as cropland had been idle 3 years or more. This land is grazed to some extent but was not included in the pasture and range acreage. Cropland acreages for Colorado and Oklahoma also include some land that had been idle or allowed to go back to pasture in recent years. These irregularities help account for some of the differences between CNI data and other Government statistics.

Land used for tame hay was included in cropland as was the acreage of wild hay harvested from irrigated land in the West. It is estimated that from 7 to 8 million acres of wild hay was excluded. If all the acreages of wild hay and of cropland used for pasture are included, the total cropland acreage is about 458 million acres, about the same as estimates based on agricultural crop estimates and the Census of Agriculture, which consider wild hay harvested as cropland harvested.

About 36.8 million acres of cropland in 18 Western States, including Hawaii, was classi-

[3] For definitions of land use classes used in CNI, see appendix.

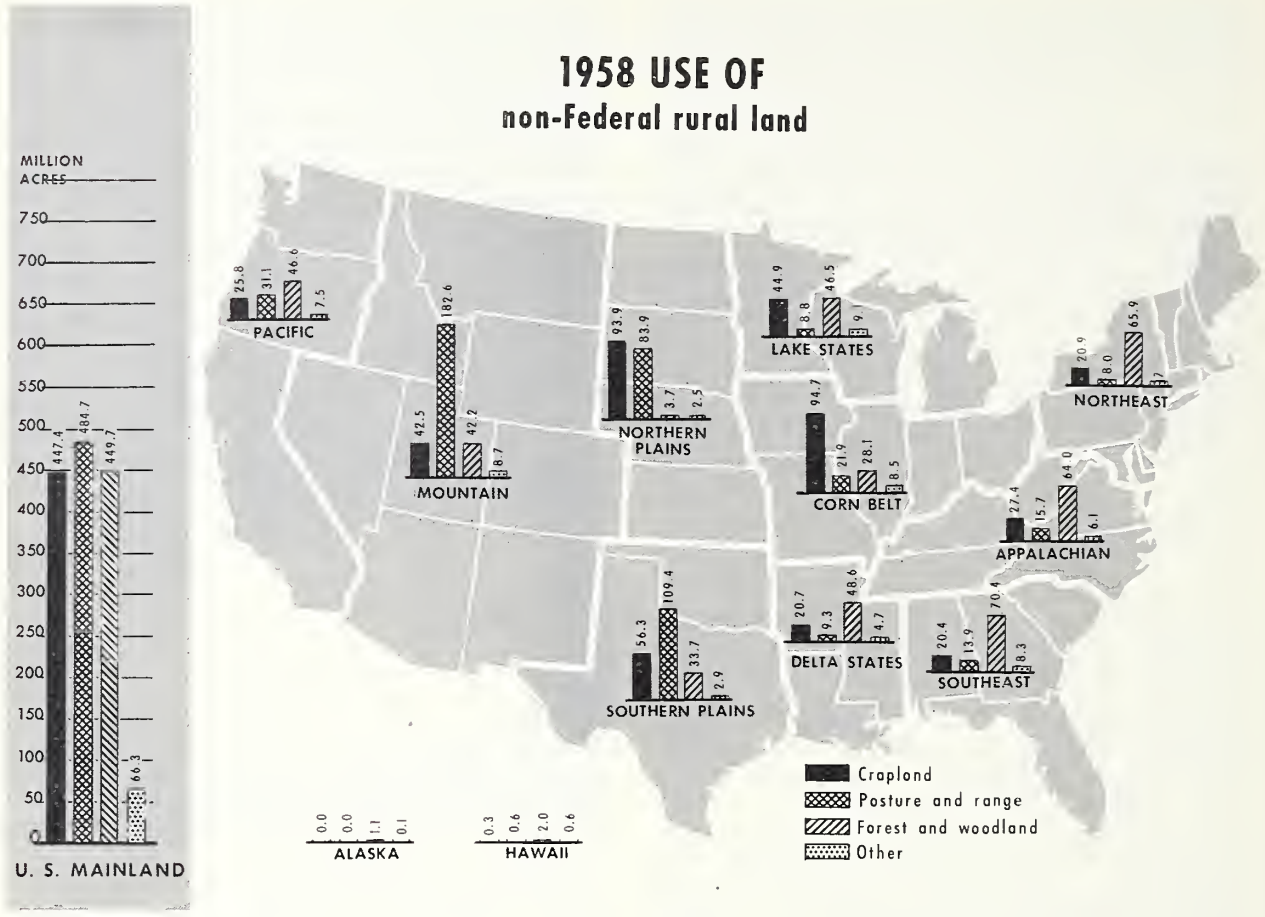


*Figure 25.*

TABLE 13.—*Total land area and land included in the Inventory, 1958*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | Total land area[1] | Excluded from the Inventory | | | | Included in the Inventory |
|---|---|---|---|---|---|---|
| | | Federal land (noncropland)[2] | Urban and builtup area[3] | Water area[4] | Total | |
| | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* |
| Northeast | 112,324 | 2,126 | 7,014 | 541 | 9,681 | 102,643 |
| Lake States | 122,709 | 7,464 | 5,294 | 679 | 13,437 | 109,272 |
| Corn Belt | 165,284 | 2,410 | 9,052 | 549 | 12,011 | 153,273 |
| Northern Plains | 194,877 | 4,897 | 5,052 | 1,019 | 10,941 | 183,936 |
| Appalachian | 124,550 | 6,922 | 3,928 | 519 | 11,369 | 113,181 |
| Southeast | 124,069 | 6,687 | 3,727 | 636 | 11,050 | 113,019 |
| Delta | 92,690 | 5,407 | 2,897 | 1,053 | 9,357 | 83,333 |
| Southern Plains | 212,305 | 3,330 | 5,777 | 817 | 9,924 | 202,381 |
| Mountain | 548,449 | 267,851 | 4,003 | 677 | 272,531 | 275,918 |
| Pacific | 204,499 | 89,061 | 3,943 | 414 | 93,418 | 111,081 |
| U.S. mainland | 1,901,756 | 396,155 | 50,660 | 6,904 | 453,719 | 1,448,037 |
| Alaska | 365,481 | 364,169 | 44 | NA | 364,212 | 1,269 |
| Hawaii | 4,106 | 473 | 62 | 3 | 539 | 3,567 |
| U.S. total | 2,271,343 | 760,797 | 50,766 | 6,907 | 818,470 | 1,452,873 |

[1] Figures rounded to nearest thousand in accordance with totals as determined for the U.S. Census of 1960.

[2] Federal cropland operated under lease or permit was included in the Inventory.

[3] Includes railroads and highways and excludes significant acreages of farmland inside city and village limits.

[4] Chiefly small reservoirs, farm ponds, small lakes and streams, generally included in the land area.

TABLE 14.—*Land use of non-Federal rural land, 1958*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | Cropland [1] | | Pasture-range | | Forest-woodland | | Other land | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *1,000 acres* | *Percent* [2] | *1,000 acres* | *Percent* [2] | *1,000 acres* | *Percent* [2] | *1,000 acres* | *Percent* [2] | *1,000 acres* | *Percent* [3] |
| Northeast | 20,907 | 20 | 7,991 | 8 | 65,913 | 64 | 7,832 | 8 | 102,643 | 7 |
| Lake States | 44,887 | 41 | 8,811 | 8 | 46,474 | 43 | 9,101 | 8 | 109,272 | 7 |
| Corn Belt | 94,727 | 62 | 21,935 | 14 | 28,078 | 18 | 8,533 | 6 | 153,273 | 10 |
| Northern Plains | [4]93,896 | 51 | 83,902 | 46 | 3,672 | 2 | 2,467 | 1 | 183,937 | 13 |
| Appalachian | [5]27,362 | 24 | 15,657 | 14 | 64,014 | 57 | 6,148 | 5 | 113,181 | 8 |
| Southeast | 20,385 | 18 | 13,930 | 12 | 70,392 | 62 | 8,313 | 8 | 113,019 | 8 |
| Delta States | 20,719 | 25 | 9,331 | 11 | 48,559 | 58 | 4,724 | 6 | 83,333 | 6 |
| Southern Plains | [4]56,251 | 28 | 109,447 | 54 | 33,737 | 17 | 2,945 | 1 | 202,381 | 14 |
| Mountain | 42,489 | 16 | 182,583 | 66 | 42,165 | 15 | 8,680 | 3 | 275,918 | 19 |
| Pacific | 25,776 | 23 | 31,130 | 28 | 46,647 | 42 | 7,528 | 7 | 111,081 | 8 |
| U.S. mainland | [5]447,399 | 31 | 484,716 | 33 | 449,651 | 31 | 66,271 | 5 | 1,448,037 | 100 |
| Alaska | [4]23 | 2 | 2 | (6) | 1,098 | 86 | 146 | 12 | 1,270 | — |
| Hawaii | 315 | 9 | 646 | 18 | 1,981 | 55 | 626 | 18 | 3,568 | — |
| U.S. total | 447,737 | 31 | 485,364 | 33 | 452,729 | 31 | 67,042 | 5 | 1,452,872 | 100 |

[1] Excludes wild hay harvested from nonirrigated land in the Western States. This is included in pasture and range acreage.

[2] Of region.

[3] Of U.S. total.

[4] Cropland includes about 4.3 million acres of land idle 3 years or more. This land is used to some extent for grazing.

[5] Cropland excludes about 2.7 million acres of land infrequently broken out of pasture for grain or other crops in Kentucky and Tennessee. This acreage is included in pasture and range.

[6] Less than 0.5 percent.

UT-1446

***Figure 26.*—Grassland used as pasture and range makes up 33 percent of the non-Federal rural land. Scrubby woodland and chaparral such as in the background of this picture were not included in the range acreage but were counted as woodland in the Inventory.**

fied as irrigated land in 1958. This estimate includes all cropland served by farm and ranch irrigation systems and also irrigated hay and irrigated cropland used only for pasture.

In addition to the private and other non-Federal land used for pasture and range (fig. 26), about 243 million acres of Federal range was used chiefly for grazing under permits granted to farmers and ranchers (Wooten 1962, table 4). The Federal range acreage, however, was not included in the Conservation Needs Inventory.

The total area of private and other non-Federal forest and woodland is 452.7 (449.7) million acres. More than one-third or 161 million acres is grazed at some time during the year and has seasonal forage of significant value for pasturage (Wooten 1962, table 4). Forest and woodland range consists mainly of the open-type pine forests of the South and West and the semiarid woodlands of the West.

Forest and woodland has other significant values, such as watershed protection, wildlife habitat, and recreation.

## EXPECTED SHIFTS IN LAND USE

Since the population of the United States is expanding rapidly and the needs for food, feed, and fiber are constantly changing, the needs for living space, recreation, and other uses of the land are increasingly competing for the available resources. These shifting requirements and pressures cause corresponding shifts in the use of specific areas of land.

In estimating conservation needs, the CNI committees took into account probable shifts in land use in the near future. The estimates of conservation treatment needs in succeeding sections of this report apply to the acreages of land expected to be in each agricultural use in 1975 and include the land use adjustments necessary to attain that pattern.

In 1958 each county CNI committee estimated the probable changes in land use within its area by 1975. The State, regional, and National totals are summations of those county estimates.

The county committees based their estimates on knowledge of local trends, taking into consideration the land-capability information provided by soil surveys and the economic assumptions adopted for the Inventory. These assumptions as stated in the Policy and Procedure for Development of National Inventory of Soil and Water Conservation Needs were:

1. There will be a population increase in the United States for the period 1953 to 1975 from 162 to 210 million. The projected increase in population and moderate rise in per capita consumption of farm products will increase requirements in 1975 to about 40 percent above 1953. Since production is in excess of utilization, an increase in farm output of around 30 percent will meet projected requirements.

2. Total acreage of crops, including cropland pasture, will be about 6 percent greater in 1975 than in the period 1951-53.

3. With the expected cropland acreage and fuller adoption by farmers of available technical knowledge in crop production, it appears that market demands in 1975 can be met if certain adjustments are made. Significant shifts will be required in the crops grown. There will also be need for shifts in major land uses, including such changes as the clearing, draining, and irrigating of land for cropland and pasture, reforestation of less productive croplands, and loss of agricultural lands to nonagricultural uses.

4. The projected increase of population and growth of the Nation's economy will expand the demand for timber products. The 1975 demand for wood products in total (industrial wood and fuel wood) may be as much as 30 percent above 1952 consumption. To meet these timber requirements, more intensive management of all available commercial forest land will be needed. It will be imperative that commercial forest lands presently nonstocked or poorly stocked be restored to productive conditions. The more critical problems will relate chiefly to increasing the growth of softwood sawtimber and the improvement of productivity of farm and other small forestland ownerships.

5. Demands for recreation facilities and for wildlife will increase more rapidly than the increase in population.

6. To meet the water requirements of the increased population, which will be accompanied by expansion of industry, intensified agriculture, and other uses, there will be increased competition for available water supplies. This will result in an expansion of water-resource development.

7. Land owners and operators will be expected to spend no more on conservation measures than will yield a reasonable return to their capital and labor.

8. The public will provide expenditures for soil and water conservation measures in addition to expenditures by land owners and operators when deemed necessary in the public interest to prevent serious permanent damage to soil and water resources.

Although these assumptions provided an economic framework for the local committees, no effort was made to calculate the acreages that would need to be devoted to the different land uses to provide a specified level of output of farm products. Each committee estimated the changes that could be expected in its area between 1958 and 1975.

Land use trends reflected in the committees' estimates were evident under agricultural programs and policies in effect in 1958 and did not anticipate the new agricultural programs of the 1960's (for example, the increased efforts to divert land from crop production and to increase recreational and other uses of land).

The resulting figures, therefore, differ somewhat from national economic projections of farm production and acreage requirements, such as those of the Department of Agriculture's Land and Water Policy Committee (1962) which attempt to fix the degree of adjustment needed to match production to demand. The CNI estimates reflect only trends recognized by the local committees at the time (under conditions and programs of the late fifties). The difference between the two estimates is a measure of the central agricultural

TABLE 15.—*Expected land use of non-Federal rural land, 1975*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | Cropland | | Pasture-range | | Forest-woodland | | Other land | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *1,000 acres* | *Percent* [1] | *1,000 acres* | *Percent* [1] | *1,000 acres* | *Percent* [1] | *1,000 acres* | *Percent* [1] | *1,000 acres* | *Percent* [2] |
| Northeast | 18,137 | 18 | 7,201 | 7 | 67,568 | 68 | 7,064 | 7 | 99,970 | 7 |
| Lake States | 44,578 | 42 | 7,533 | 7 | 46,203 | 43 | 8,763 | 8 | 107,077 | 7 |
| Corn Belt | 94,490 | 63 | 20,401 | 14 | 26,768 | 18 | 7,857 | 5 | 149,516 | 10 |
| Northern Plains | 91,670 | 50 | 85,424 | 47 | 3,607 | 2 | 2,411 | 1 | 183,112 | 13 |
| Appalachian | 25,779 | 23 | 17,022 | 15 | 64,007 | 57 | 5,018 | 5 | 111,826 | 8 |
| Southeast | 18,252 | 17 | 15,557 | 14 | 70,888 | 64 | 5,116 | 5 | 109,813 | 8 |
| Delta States | 18,996 | 23 | 12,704 | 15 | 46,811 | 57 | 4,191 | 5 | 82,703 | 6 |
| Southern Plains | 53,950 | 27 | 116,015 | 58 | 28,133 | 14 | 2,712 | 1 | 200,810 | 14 |
| Mountain | 43,505 | 16 | 184,799 | 66 | 40,551 | 15 | 8,929 | 3 | 277,784 | 19 |
| Pacific | 26,828 | 24 | 30,496 | 28 | 45,146 | 41 | 7,679 | 7 | 110,149 | 8 |
| U.S. mainland | 436,185 | 30 | 497,153 | 35 | 439,682 | 31 | 59,739 | 4 | 1,432,760 | 100 |
| Alaska | 78 | 6 | 30 | 3 | 993 | 80 | 140 | 11 | 1,241 | — |
| Hawaii | 330 | 9 | 742 | 21 | 1,850 | 52 | 625 | 18 | 3,546 | — |
| U.S. total | 436,593 | 30 | 497,924 | 35 | 442,524 | 31 | 60,504 | 4 | 1,437,544 | 100 |

[1] Of region.
[2] Of U.S. mainland.

problem in the sixties—how to bring land use in balance with production needs of the time.

The following estimates of land use changes, therefore, are a projection of trends in effect at the time of the Inventory. The estimates of conservation treatment needs are for the acreages and classes of land expected to be in each use in 1975 as a result of those trends (table 15).

**Net changes in land use**

Even with substantial increases in population and demand for farm products, the CNI committees forsaw a net change of agricultural land to less intensive uses and to urban and built-up areas and other nonagricultural uses (table 16).

Cropland is expected to decrease by more than 11 million acres from 1958 to 1975, and the combined acreage of woodland and other land to decrease by nearly 17 million acres. In contrast, pasture and range is expected to increase about 12.6 (12.4) million acres during this period.

At the same time some 20.8 million acres is expected to go out of agricultural use into urban and built-up areas or other nonagricultural uses while 5.4 million acres of rural land is coming into agriculture, mainly from Federal holdings in the West. This shifting would result in a net decrease of 15.4 million acres in the Nation's agricultural plant by 1975.

**Shifts between land uses**

Although the expected shifts in land use would not result in large net changes in the acreages devoted to each major agricultural use by 1975, the Committees' estimates indicate that much land will move back and forth between the uses, and into or out of agriculture, during the period (table 17, fig. 27).

Of the nearly 448 million acres in cropland

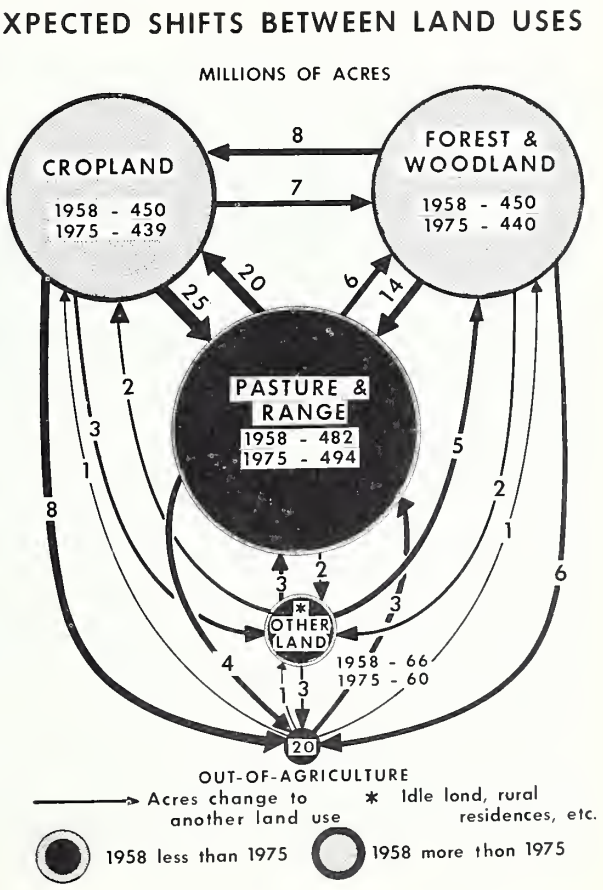


*Figure 27.*

TABLE 16.—*Expected net changes in land*

[Because of rounding, some totals may not equal the sum of the

| Region | Cropland | | Pasture-range | | Forest-woodland | |
|---|---|---|---|---|---|---|
| | *1,000 acres* | *Percent* [1] | *1,000 acres* | *Percent* [1] | *1,000 acres* | *Percent* [1] |
| Northeast | − 2,771 | − 15 | − 789 | − 11 | + 1,654 | + 2 |
| Lake States | − 309 | − 1 | − 1,278 | − 17 | − 271 | − 1 |
| Corn Belt | − 237 | ([2]) | − 1,534 | − 8 | − 1,310 | − 5 |
| Northern Plains | − 2,226 | − 2 | + 1,522 | + 2 | − 65 | − 2 |
| Appalachian | − 1,583 | − 6 | + 1,365 | + 8 | − 8 | ([2]) |
| Southeast | − 2,133 | − 12 | + 1,627 | + 10 | + 496 | + 1 |
| Delta States | − 1,722 | − 9 | + 3,374 | + 27 | − 1,748 | − 4 |
| Southern Plains | − 2,301 | − 4 | + 6,567 | + 6 | − 5,604 | − 20 |
| Mountain | + 1,016 | + 2 | + 2,216 | + 1 | − 1,614 | − 4 |
| Pacific | + 1,052 | + 4 | − 634 | − 2 | − 1,500 | − 3 |
| U.S. mainland | −11,214 | − 3 | +12,436 | + 3 | − 9,968 | − 2 |
| Alaska | + 55 | + 71 | + 28 | ([3]) | − 106 | − 11 |
| Hawaii | + 15 | + 5 | + 96 | + 13 | − 132 | − 7 |
| U.S. total | −11,145 | − 3 | +12,560 | + 3 | −10,205 | − 2 |

[1] Of 1958 acreage.
[2] Less than 0.5 percent.
[3] A very large percentage increase.

in 1958, about 406 million acres will remain in that use. The nearly 42 million acres of cropland expected to be converted to other uses will be largely offset by the 31 million acres coming into cropland, leaving a net decline of 11 million acres or 3 percent of the 1958 total.

Of the 42 million acres expected to go out of cropland, nearly 25 million acres will be con-

TENN-D65-1

*Figure 28.*—**More than half the land expected to go out of cropland by 1975 will be converted to pasture or range, as was this hillside.**

*use of non-Federal rural land, 1958 to 1975*

items listed and data may not check exactly with summary tables]

| Other land | | Total | | Going out of agriculture | | Coming into agriculture |
|---|---|---|---|---|---|---|
| | | | | Total | To urban and builtup areas | |
| *1,000 acres* | *Percent* [1] | *1,000 acres* | *Percent* [1] | *1,000 acres* | *1,000 acres* | *1,000 acres* |
| — 768 | — 11 | — 2,673 | —2.7 | 2,704 | 2,312 | 31 |
| — 338 | — 4 | — 2,195 | —2.2 | 2,257 | 1,996 | 61 |
| — 676 | — 9 | — 3,757 | —2.5 | 3,759 | 3,190 | 2 |
| — 56 | — 2 | — 825 | ([3]) | 832 | 403 | 8 |
| — 1,130 | — 23 | — 1,355 | —1.2 | 1,357 | 1,019 | 2 |
| — 3,197 | — 62 | — 3,206 | —2.9 | 3,322 | 2,061 | 116 |
| — 533 | — 13 | — 630 | —0.8 | 629 | 421 | 0 |
| — 233 | — 9 | — 1,571 | —0.8 | 1,576 | 938 | 5 |
| + 248 | + 3 | + 1,866 | +0.7 | 1,630 | 1,238 | 3,497 |
| + 150 | + 2 | — 932 | —0.8 | 2,651 | 2,243 | 1,719 |
| — 6,531 | — 11 | —15,277 | —1.1 | 20,717 | 15,821 | 5,441 |
| — 6 | — 4 | — 28 | —2.3 | 29 | 0 | 0 |
| — 1 | ([3]) | — 22 | —0.6 | 22 | 22 | 0 |
| — 6,538 | — 11 | —15,328 | —1.1 | 20,767 | 15,843 | 5,441 |

verted to pasture and range (fig. 28), about 6.6 million to woodland (fig. 29), and about 2.6 million to other uses. About 8 million acres will go out of agriculture, largely to urban and industrial uses (table 17). On the other hand, nearly 20 million acres will come into cropland from pasture and range, 7.5 million from woodland, 2.3 million from other land, and 1.1 million from land not now in agricultural use.

The Southern States (Southeast, Delta States, and Southern Plains) are expected to shift about 10 million acres of cropland to pasture (fig. 30). Some conversion of cropland and pasture to forest is also expected in these regions. Urban and industrial expansion will continue to absorb rural land.

MICH-190-B

***Figure 29.*—About 6.6 million acres of cropland is expected to be converted to woodland by 1975. This pine plantation is typical of the young new woodlands.**

The Northeast, Corn Belt, and Lake States likely will continue to lose cropland and pasture to industrial and urban development and to public facilities such as highways, airports, rural parks, recreational areas, and reservoirs.

The Mountain and Pacific regions are expected to gain cropland acreage while the Northern Plains lose cropland.

Observations of these conditions in the early 1960's indicate that even greater shifts are actually occurring than were anticipated at the time of the Inventory. This speedup in land use conversions results, in part, from new legislation and new objectives that are being developed for agriculture.

Pasture and range is expected to increase by nearly 13 million acres, from about 485 million in 1958 to 498 million in 1975. About 28 million acres is expected to shift to other uses, most of it to cropland but more than 4 million acres to urban, industrial, and other nonagricultural uses. Conversely, nearly 45 million acres, including nearly 3 million not now in agricultural use, will come into pasture and range.

Six regions are expected to show increases in pasture and range acreage, the highest percentage change, 27 percent, being in the Delta States. Large increases are expected also in the Southeast and Appalachian regions as new pasture replaces cropland going out of production. In general, the southern half of the United States is moving toward a livestock-pasture economy and away from cash crops.

Expected decreases in pasture acreage are concentrated in the Northeast and Lake States, although the acreages are small. The largest

TABLE 17.—*Shifts of land*

[Because of rounding, some totals may not equal the sum of the

| Region | Total land involved in shifts | From cropland to— | | | | | From pasture and range to— | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Pasture-range | Forest-woodland | Other land | Out of agriculture | Total | Cropland | Forest-woodland | Other land | Out of agriculture | Total |
| | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* |
| Northeast | 9,641 | 1,042 | 932 | 650 | 1,016 | 3,640 | 447 | 1,129 | 374 | 253 | 2,203 |
| Lake States | 8,823 | 553 | 818 | 469 | 1,099 | 2,939 | 1,509 | 499 | 238 | 190 | 2,436 |
| Corn Belt | 16,671 | 2,705 | 611 | 489 | 2,258 | 6,063 | 3,932 | 880 | 297 | 503 | 5,612 |
| Northern Plains | 10,119 | 4,917 | 280 | 79 | 515 | 5,791 | 3,328 | 85 | 38 | 244 | 3,695 |
| Appalachian | 11,932 | 2,382 | 916 | 252 | 472 | 4,022 | 981 | 1,339 | 186 | 274 | 2,780 |
| Southeast | 15,037 | 1,820 | 1,909 | 206 | 426 | 4,361 | 791 | 1,194 | 153 | 498 | 2,636 |
| Delta States | 8,818 | 2,385 | 821 | 135 | 182 | 3,523 | 402 | 504 | 25 | 111 | 1,042 |
| Southern Plains | 18,356 | 5,752 | 197 | 72 | 503 | 6,524 | 3,394 | 82 | 662 | 655 | 4,793 |
| Mountain | 13,926 | 2,691 | 30 | 118 | 474 | 3,313 | 3,317 | 170 | 123 | 752 | 4,362 |
| Pacific | 8,477 | 381 | 69 | 113 | 1,036 | 1,599 | 1,557 | 133 | 140 | 806 | 2,636 |
| U.S. mainland | 121,798 | 24,626 | 6,582 | 2,583 | 7,981 | 41,772 | 19,660 | 6,014 | 2,236 | 4,285 | 32,195 |
| Alaska | 115 | — | 1 | — | 1 | 2 | — | — | — | — | — |
| Hawaii | 244 | 7 | 3 | — | 8 | 18 | 6 | — | — | 6 | 12 |
| U.S. total | 122,160 | 24,633 | 6,585 | 2,583 | 7,990 | 41,791 | 19,666 | 6,014 | 2,236 | 4,291 | 32,207 |

[1] Less than 500 acres.

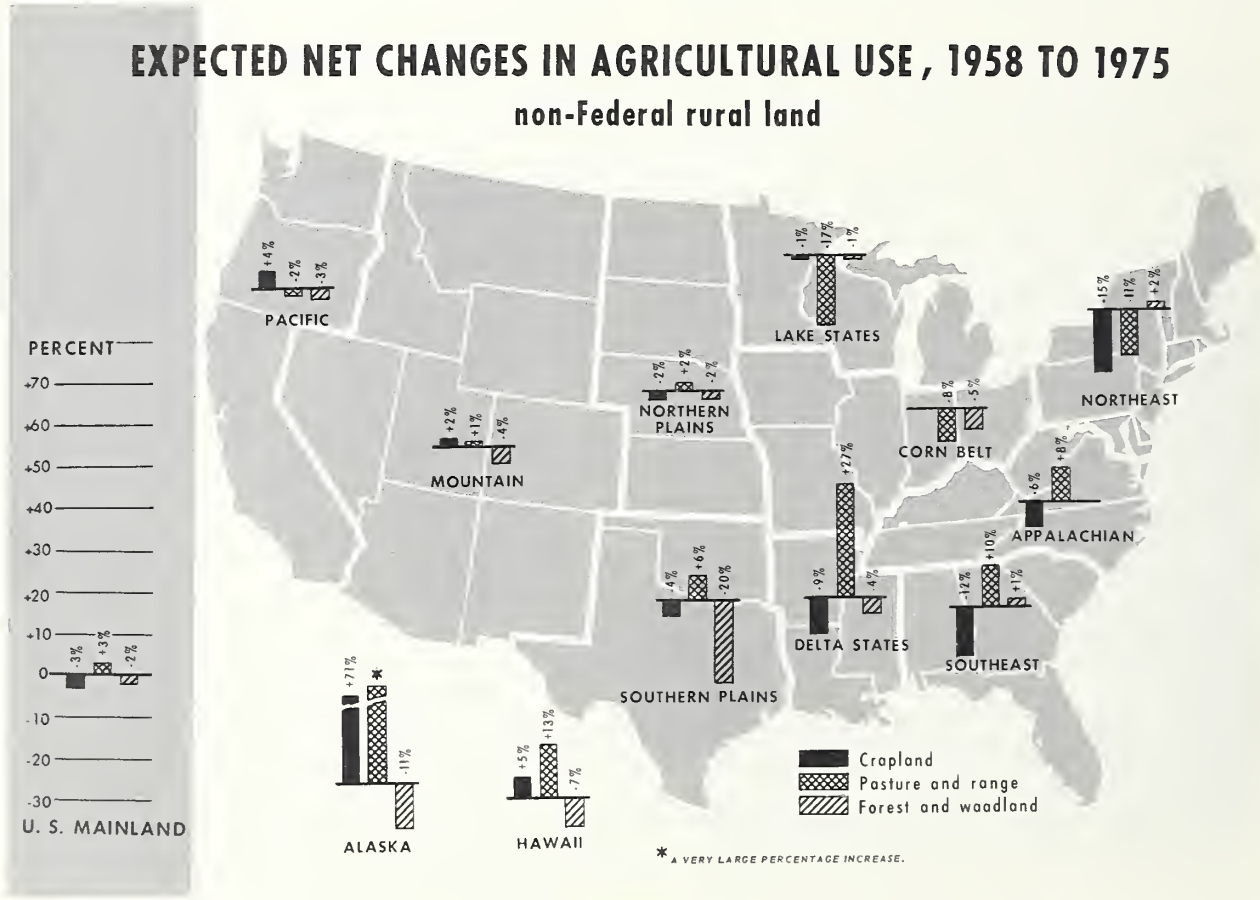


*Figure 30.*

*between uses, 1958 to 1975*

items listed and data may not check exactly with summary tables]

| From forest and woodland to— | | | | | From other land to— | | | | | From Federal land and nonagricultural uses to— | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cropland | Pasture-range | Other land | Out of agriculture | Total | Cropland | Pasture-range | Forest-woodland | Out of agriculture | Total | Cropland | Pasture-range | Forest-woodland | Other land | Total |
| *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* |
| 265 | 207 | 264 | 964 | 1,700 | 157 | 165 | 1,275 | 470 | 2,067 | (1) | (1) | 19 | 11 | 31 |
| 725 | 483 | 254 | 626 | 2,088 | 396 | 122 | 439 | 342 | 1,299 | 0 | 0 | 61 | 0 | 61 |
| 1,490 | 1,083 | 136 | 687 | 3,396 | 402 | 291 | 595 | 310 | 1,598 | 1 | (1) | 1 | 0 | 2 |
| 156 | 231 | 2 | 59 | 448 | 77 | 67 | 19 | 14 | 177 | 3 | 3 | 0 | 2 | 8 |
| 1,229 | 1,275 | 290 | 476 | 3,270 | 228 | 487 | 1,008 | 135 | 1,858 | 1 | (1) | 1 | (1) | 2 |
| 978 | 1,693 | 258 | 1,183 | 4,112 | 459 | 750 | 1,389 | 1,215 | 3,813 | 0 | 0 | 115 | (1) | 115 |
| 1,313 | 1,779 | 84 | 300 | 3,476 | 85 | 253 | 403 | 36 | 177 | 0 | 0 | 0 | 0 | 0 |
| 660 | 4,895 | 82 | 348 | 5,985 | 168 | 709 | 103 | 69 | 1,049 | 1 | 4 | 0 | 0 | 5 |
| 285 | 1,465 | 55 | 282 | 2,087 | 177 | 360 | 6 | 123 | 666 | 550 | 2,064 | 267 | 617 | 3,498 |
| 387 | 1,029 | 137 | 575 | 2,128 | 149 | 6 | 5 | 235 | 395 | 558 | 585 | 419 | 156 | 1,719 |
| 7,487 | 14,140 | 1,563 | 5,501 | 28,691 | 2,298 | 3,209 | 5,242 | 2,950 | 13,699 | 1,114 | 2,657 | 883 | 787 | 5,441 |
| 57 | 23 | 1 | 25 | 106 | — | 4 | — | 3 | 7 | 0 | 0 | 0 | 0 | 0 |
| 24 | 101 | 40 | 8 | 173 | 1 | — | 39 | 1 | 41 | 0 | 0 | 0 | 0 | 0 |
| 7,568 | 14,264 | 1,604 | 5,533 | 28,969 | 2,299 | 3,214 | 5,281 | 2,954 | 13,748 | 1,114 | 2,657 | 883 | 787 | 5,441 |

MD-30367

***Figure 31.*—Nearly 16 million acres of agricultural land is expected to be taken up by urban development and other built-up areas by 1975.**

percentage changes will be in the six New England States.

Forest and woodland is expected to decrease by 10 million acres, from nearly 453 million in 1958 to about 442 million in 1975. About 29 million acres of forest and woodland will shift to other uses, of which more than 14 million will go to pasture and range, and 5.5 million to nonagricultural uses. About 18 million acres will come into forest and woodland from other agricultural uses plus nearly a million acres from present Federal land.

The more permanent nature of forest and woodland probably accounts for the small degree of change expected in this land use. Only two regions—the Northeast and Southeast—are expected to show an increase, and that amounts to only 2.2 million acres.

The largest decrease is expected in the Southern Plains where some of the noncommercial forest and woodland is expected to be converted to pasture and range.

By individual States, the largest percentage increase is expected in the Dakotas. These States will add more windbreak plantings to their present small acreage of woodland.

Other land is expected to decrease from 67 million acres in 1958 to 60.6 million in 1975, a net change of more than 6 million acres. Nearly 14 million acres will shift out of other land and more than 7 million into these uses.

In addition to the shifts between agricultural uses, nearly 21 million acres will go out of agriculture by 1975. Three-fourths of this or 15.8 million acres will be devoted to urban and built-up areas (fig. 31). In the meantime, some 5 million acres is expected to come into agricultural use, mainly from Federal land in the West. The net loss to the agricultural plant, therefore, will be about 15 million acres, or an average of 1 million acres per year.

Altogether, about 122 million acres are included in the expected shifts between agricultural land uses and into and out of agriculture. The total areas range from about 18.4 million acres in the Southern Plains to 8.5 million acres in the Pacific region. Four regions—Southern Plains, Corn Belt, Southeast and Mountain—account for more than half the acreage in shifts expected by 1975.

These shifts in land use will have a heavy impact on conservation needs. New conservation and development measures are needed to change land from one use to another and to protect it from deterioration in its new use. The 30.6 million acres that is expected to become cropland by 1975 will require land preparation and protection according to its location, physical condition, and prior land use. Similarly, the nearly 45 million acres that is expected to become pasture and range will require certain treatment to establish new plant cover and bring it into forage production. The nearly 19 million acres expected to become forest and woodland by 1975 will require stand establishment and protection. A special and varied conservation program is needed also for the 5.4 million acres coming into agricultural use.

# Part II. Conservation Treatment Needs

## *Land Use Changes and Conservation*

The United States is experiencing the greatest period of land use adjustment since the completion of land settlement. Advancing agricultural technology and widespread urbanization combine to change the character of farming and of the rural landscape with ever-increasing speed.

These changes profoundly affect the use and management of soil and water. Not only are conservation treatments needed on land not yet adequately protected, but new or better treatments are needed on land being changed to new uses. Continued maintenance is also needed for conservation measures on land that will stay in its present use.

Many of the land use trends are favorable to conservation treatment. For example, converting crop fields to grassland, woodland, or wildlife land reduces the erosion hazard. Contrarily, converting cropland, grassland, and wooded areas to intensive recreation and urban uses may increase the erosion hazard and complicate required treatment. These effects must be understood clearly so that landowners and conservationists may plan effectively for future conservation needs.

### ESTIMATES OF TREATMENT NEEDS

The Conservation Needs Inventory provided estimates of the conservation treatment needs of each land use consistent with the expected trends. The needs are expressed as acreages in each land use having certain conservation problems and acreages needing treatment.

The problems of cropland and "other land" are related primarily to conservation of the soil resource. Estimates of these problems were based on land-capability data provided by soil surveys.

The problems of pasture and range and of forest and woodland are related to conservation of the plant cover as well as to conservation of the soil resource. Estimates of conservation needs for these land uses, therefore, were based on the condition of the plant cover at the time of the inventory and were made without direct reference to land-capability data.

The acreage needing treatment for each land use takes into account the treatment needed for land expected to come into that use by 1975 as well as land already in the use.

## *Cropland*

Cropland conservation requires combinations of *enduring* land-improvement measures and *recurring* cultural and management practices. Seldom will either type of treatment suffice alone; usually both need to be used together. The conservation job is not complete when the required terraces, stripcropping patterns, grassed waterways, surface ditches, or tile drains have been installed. These can be no more effective than the annual maintenance or the recurring tillage and management that are used with them.

Moreover, enduring practices such as terraces, contour farming, and water-disposal systems may be impractical on some cropland because of its peculiar topography or soil or some other condition. The operators of such land must rely on vegetation and cultural practices to protect and improve the soil.

Conditions vary so widely that many different systems of soil, water, and crop management are required to meet the needs of the land and its users. Modern technology provides the land operator with many satisfactory systems of soil and water conservation.

The alternatives are so variable that it would be impractical to estimate the amounts of specific conservation practices needed. Instead, the Conservation Needs Inventory (CNI) expressed conservation needs of cropland in terms of the problems limiting the capability of land for cultivation. As previously discussed, this information was obtained from basic soil data interpreted in terms of land capability. Thus all land used for cropland in 1958 or expected to be in that use by 1975 except class I land has a problem of erosion, excess water, unfavorable soil, or adverse climate serious enough to impose limits or hazards to its use. Any of these problems may occur alone or may be accompanied by one or more of the others. Only dominant and secondary problems, however, were delineated in the CNI.

### LAND USED FOR CROPLAND

Cropland as defined in the CNI includes all land currently tilled or being held in temporary

cover for future cultivation. It includes cropland harvested, crop failure, idle cropland, fallow land, land being prepared for crops, cropland in soil-improvement crops, rotation pasture, tame hay, wild hay harvested east of the Mississippi (and some irrigated native hay west of the Mississippi), and land in vegetables, fruits, and nuts including those grown on farms for home use.

According to this definition, local CNI committees reported 447.7 million acres in the 50 States including Alaska and Hawaii (447.4 million in the 48 mainland States) of cropland in 1958, including small amounts of cropland on Federal land under lease or permit. This figure differs slightly, but not significantly, from the total of 458.0 (457.5) million acres of cropland reported by the Economic Research Service (ERS) for 1958 (table 18). Differences exist, however, in acreages reported by the two sources for several States, especially Colorado, Kentucky, Tennessee, and Texas. These differences are largely due to variations in definition of cropland, such as inclusion or exclusion of wild hay harvested, soil-bank land, cropland used for pasture, and idle land.

The Economic Research Service reported that the 458 million acres of cropland in 1959 was used as follows: 358.8 (358.5) million acres for crops, 33.6 million acres for soil improvement crops and idle (including soil bank acreage), and 65.6 (65.4) million acres for pasture only. It also reported 317 million acres of cropland harvested in that year (Wooten 1962).

The analyses of land capability and of conservation treatment needs of cropland in this report apply to the cropland acreages reported by the CNI committees.

## LAND CAPABILITY OF CROPLAND

As previously mentioned land-capability information from the CNI shows that most of the land now used for cropland can safely be cultivated if protected by adequate conservation practices (fig. 32).

About 49 million acres or 11 percent of cropland in 1958, however, was class IV land that is suitable for only occasional or limited cultivation. In addition, more than 25 million acres or nearly 6 percent was class V-VIII land that is not generally suitable for cultivation.

The low-grade cropland presents a major conservation problem. Most class V-VIII land can best be used for some purpose that keeps it in permanent vegetation, although some soils may feasibly be kept in speciality crops with highly intensive protective measures. The class IV land will require constant attention and intensive conservation measures as long as it is cultivated. In many circumstances, the most practical and economic solution is to convert such land to pasture or range, woodland, or other uses that provide a permanent vegetative cover.

The CNI indicates that progress has been made in the past decade in shifting low-grade cropland to other uses. Estimates made in 1948-49 by the Soil Conservation Service indicated that cropland of the U.S. mainland at that time included about 39 million acres or 8 percent of class V–VIII land (SCS 1953). The

TABLE 18.—*Cropland in the United States, 1958 and 1959*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | Included in Inventory, 1958 [1] | Total cropland, 1959 [2] | | | |
|---|---|---|---|---|---|
| | | Used for crops | Used for soil improvement crops and idle | Used only for pasture | Total |
| | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* |
| Northeast | 20,907 | 15,189 | 2,567 | 3,217 | 20,973 |
| Lake States | 44,887 | 36,668 | 4,170 | 4,657 | 45,495 |
| Corn Belt | 94,728 | 78,814 | 3,454 | 12,822 | 95,090 |
| Northern Plains | 93,896 | 90,199 | 6,160 | 4,695 | 101,054 |
| Appalachian | 27,362 | 17,431 | 3,061 | 9,498 | 29,990 |
| Southeast | 20,385 | 14,566 | 2,208 | 4,297 | 21,071 |
| Delta States | 20,718 | 13,070 | 1,806 | 5,932 | 20,808 |
| Southern Plains | 56,251 | 37,651 | 5,479 | 10,786 | 53,916 |
| Mountain | 42,489 | 34,404 | 3,710 | 4,838 | 42,952 |
| Pacific | 25,776 | 20,464 | 971 | 4,699 | 26,134 |
| U.S. mainland [3] | 447,399 | 358,456 | 33,586 | 65,441 | 457,483 |
| Alaska | 23 | 16 | 4 | 4 | 24 |
| Hawaii | 315 | 320 | 13 | 167 | 500 |
| U.S. total | 447,737 | 358,792 | 33,603 | 65,612 | 458,007 |

[1] Includes all private and non-Federal public cropland, plus cropland on Federal land under lease to private operators.

[2] Wooten, et. al., 1962, table 16.

[3] Differences in cropland acreages reported from two sources are largely because of variation in definitions of cropland (see text).

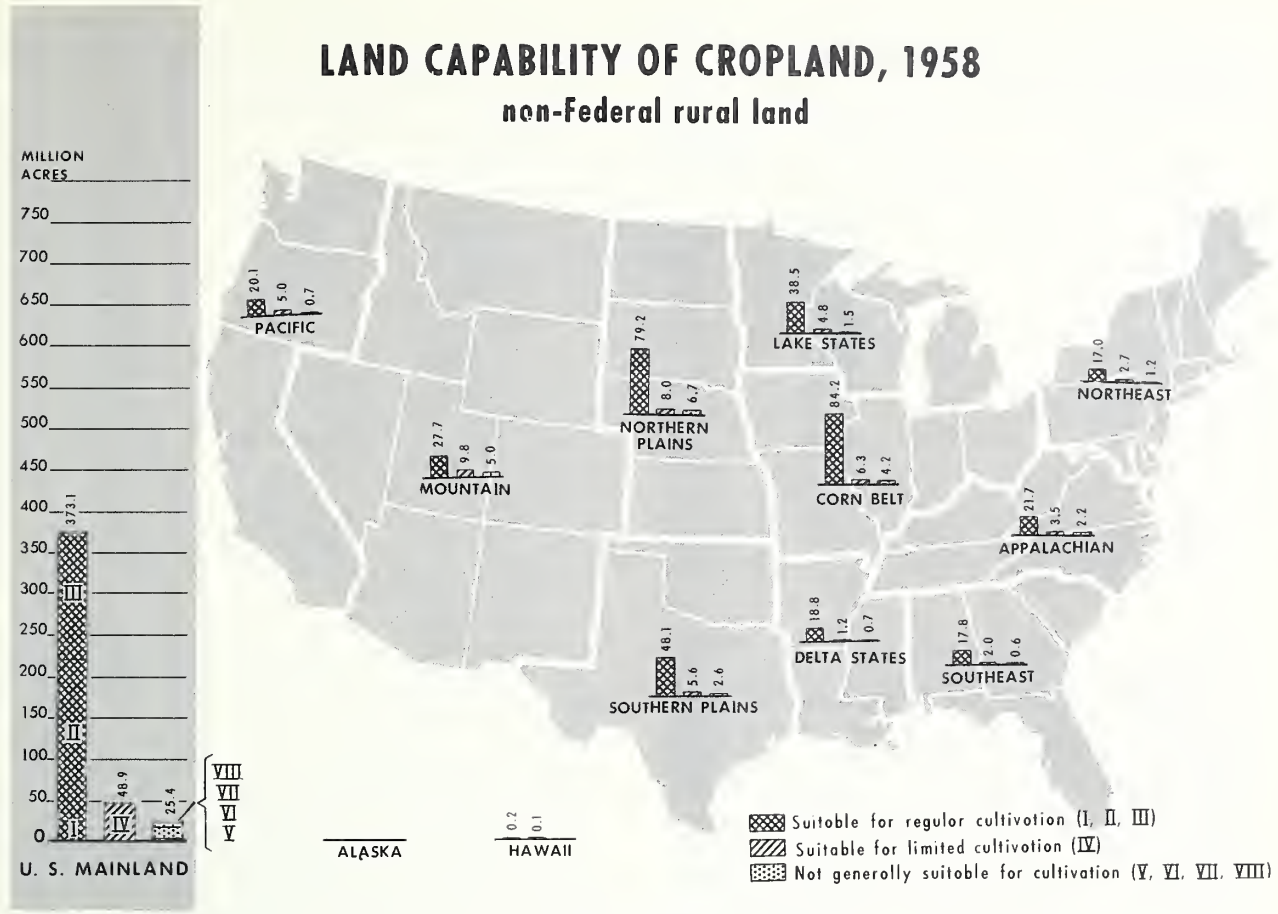


*Figure 32.*

TABLE 19.—*Land capability of cropland, 1958*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | Suitable for regular cultivation | | | | Suitable for limited cultivation | Not generally suitable for cultivation | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class I | Class II | Class III | Total I-III | Class IV | Class V | Class VI | Class VII | Class VIII | Total V-VIII | |
| | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* |
| Northeast | 1,188 | 9,076 | 6,700 | 16,964 | 2,730 | 3 | 917 | 280 | 14 | 1,214 | 20,907 |
| Lake States | 2,050 | 24,552 | 11,892 | 38,494 | 4,847 | 167 | 744 | 624 | 12 | 1,547 | 44,887 |
| Corn Belt | 6,062 | 52,333 | 25,797 | 84,192 | 6,329 | 263 | 2,401 | 1,519 | 24 | 4,207 | 94,728 |
| Northern Plains | 3,829 | 36,750 | 38,616 | 79,195 | 8,021 | 318 | 5,903 | 458 | 1 | 6,680 | 93,896 |
| Appalachian | 1,694 | 12,642 | 7,316 | 21,652 | 3,536 | 35 | 1,576 | 560 | 2 | 2,174 | 27,362 |
| Southeast | 1,585 | 9,584 | 6,679 | 17,848 | 1,952 | 101 | 321 | 160 | 2 | 584 | 20,385 |
| Delta States | 2,169 | 8,650 | 8,000 | 18,819 | 1,203 | 139 | 274 | 281 | 0 | 696 | 20,718 |
| Southern Plains | 4,451 | 22,187 | 21,503 | 48,141 | 5,557 | 622 | 993 | 938 | 0 | 2,554 | 56,251 |
| Mountain | 1,855 | 8,529 | 17,289 | 27,673 | 9,836 | 109 | 4,113 | 748 | 9 | 4,980 | 42,489 |
| Pacific | 2,534 | 8,504 | 9,094 | 20,132 | 4,898 | 16 | 663 | 65 | 1 | 746 | 25,776 |
| U.S. mainland | 27,418 | 192,808 | 152,885 | 373,111 | 48,910 | 1,773 | 17,905 | 5,634 | 66 | 25,380 | 447,399 |
| Alaska | 0 | 14 | 6 | 20 | 2 | 0 | 1 | 0 | 0 | 1 | 23 |
| Hawaii | 18 | 101 | 79 | 198 | 81 | 0 | 34 | 1 | 0 | 36 | 315 |
| U.S. total | 27,435 | 192,923 | 152,970 | 373,329 | 48,993 | 1,773 | 17,940 | 5,636 | 66 | 25,417 | 447,737 |

TABLE 20.—*Expected changes in cropland, 1958 to 1975*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | Total cropland, 1958 | Land going out of cropland | Land coming into cropland | Total cropland, 1975 | Net change | |
|---|---|---|---|---|---|---|
| | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *Percent* |
| Northeast | 20,907 | 3,639 | 869 | 18,136 | — 2,770 | — 13 |
| Lake States | 44,887 | 2,939 | 2,630 | 44,578 | — 309 | — 1 |
| Corn Belt | 94,727 | 6,062 | 5,825 | 94,490 | — 237 | (1) |
| Northern Plains | 93,896 | 5,791 | 3,564 | 91,670 | — 2,226 | — 2 |
| Appalachian | 27,362 | 4,022 | 2,439 | 25,779 | — 1,583 | — 6 |
| Southeast | 20,385 | 4,361 | 2,228 | 18,252 | — 2,133 | — 10 |
| Delta States | 20,719 | 3,523 | 1,800 | 18,997 | — 1,722 | — 8 |
| Southern Plains | 56,251 | 6,524 | 4,223 | 53,950 | — 2,301 | — 4 |
| Mountain | 42,489 | 3,312 | 4,328 | 43,505 | + 1,016 | + 2 |
| Pacific | 25,776 | 1,599 | 2,651 | 26,828 | + 1,052 | + 4 |
| U.S. mainland | 447,399 | 41,771 | 30,559 | 436,185 | —11,214 | — 3 |
| Alaska | 23 | 2 | 57 | 78 | + 55 | +240 |
| Hawaii | 315 | 17 | 32 | 329 | + 14 | + 4 |
| U.S. total | 447,737 | 41,791 | 30,648 | 436,592 | —11,145 | — 2 |

[1] Less than 0.5 percent.

CNI reported about 25 million acres or 6 percent of class V–VIII land used for cropland in 1958. Although the earlier estimates were not as complete or detailed as the current CNI, the trend indicated by this comparison is the result to be expected of the widespread conservation efforts of the past two decades.

The Nation's better cropland is concentrated largely in 4 of the 10 farm production regions (table 19). About two-thirds of the total area of class I, II, and III land is in the Corn Belt, Northern Plains, Southern Plains, and Lake States regions. This indicates where the major part of future crop production is likely to be.

Three of these regions—Northern Plains, Southern Plains, and Corn Belt—and the Mountain region also contain a major part of the maginal, class IV land that needs special attention. Nearly two-thirds of the class V–VIII land is in the Northern Plains, Corn Belt, and Mountain regions.

## EXPECTED CHANGES IN CROPLAND

Based on conditions prevailing in 1958 and on agricultural programs then in effect, county CNI committees estimated changes in cropland acreage expected by 1975. These estimates were based on local knowledge of conditions prevailing at that time, before the impact of more recent programs and legislation for agriculture. The resulting estimates of cropland in 1975 are the basis of the committees' estimates of conservation treatment needs on cropland.

TABLE 21.—*Land expected to*

[Because of rounding, some totals may not equal the sum of the

| Region | To pasture-range | | | | To forest-woodland | | | |
|---|---|---|---|---|---|---|---|---|
| | Class I-III | Class IV | Class V-VIII | Total | Class I-III | Class IV | Class V-VIII | Total |
| | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* |
| Northeast | 585 | 270 | 186 | 1,042 | 526 | 206 | 199 | 932 |
| Lake States | 195 | 162 | 196 | 553 | 270 | 358 | 190 | 818 |
| Corn Belt | 881 | 743 | 1,081 | 2,705 | 190 | 120 | 301 | 611 |
| Northern Plains | 1,374 | 1,212 | 2,331 | 4,917 | 234 | 21 | 25 | 280 |
| Appalachian | 1,187 | 568 | 626 | 2,381 | 354 | 245 | 317 | 916 |
| Southeast | 1,438 | 283 | 99 | 1,820 | 1,265 | 419 | 223 | 1,907 |
| Delta States | 1,921 | 274 | 190 | 2,385 | 467 | 139 | 215 | 821 |
| Southern Plains | 3,147 | 1,359 | 1,247 | 5,753 | 92 | 48 | 56 | 196 |
| Mountain | 569 | 835 | 1,286 | 2,690 | 15 | 10 | 5 | 30 |
| Pacific | 105 | 184 | 92 | 381 | 23 | 27 | 20 | 70 |
| U.S. mainland | 11,402 | 5,890 | 7,334 | 24,626 | 3,438 | 1,593 | 1,551 | 6,582 |
| Alaska | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| Hawaii | 2 | 3 | 2 | 7 | 0 | 0 | 3 | 3 |
| U.S. total | 11,404 | 5,893 | 7,336 | 24,633 | 3,438 | 1,593 | 1,555 | 6,586 |

**Net changes**

The shifting of land from cropland to other uses is a normal trend that reflects changing impacts of many factors and conditions on land use.

Altogether, about 41.8 million acres of cropland will be converted to other uses by 1975 and 30.6 million acres will come into cropland from other uses (table 20). This would amount to a net reduction of about 11.1 million acres, or 3 percent of the 1958 acreage, although 9 percent of the present cropland would no longer be in its present use.

According to the Inventory, the Mountain and Pacific regions are expected to have about 2 million acres more cropland in 1975 than in 1958. In the same period, cropland acreage is expected to decline more than 2 million acres in the Northeast, Northern Plains, Southern Plains, and Southeast regions.

Trends during the last several years indicate that land is being converted from cropland to other uses much more rapidly than it is being converted to cropland from other uses.

Soil Conservation Service records for the last 4 years indicate that about 2.5 million acres is shifted from cropland to other uses each year, whereas only about 0.3 million acres is shifted to cropland. If these trends continue at the present rate, the expected conversion of 41.8 million acres from cropland could be accomplished by 1975. The present rate of conversion to cropland, however, would take about 100 years to make the 30.6 million acre change anticipated by the CNI.

**Land going out of cropland**

About 41.8 million acres is expected to be converted from cropland by 1975 (table 21). Of this, about 60 percent or 24.6 million acres will go to pasture and range. The remainder will include 6.6 million acres converted to forest and woodland, 2.6 million acres to other land, and 7.9 million acres to urban and other nonagricultural uses.

About 7.0 million acres or 17 percent of the land going out of cropland will go into urban development. (This is more than all the cropland in Pennsylvania in 1958.) About 4 million acres will be in the Northeast, Lake States, and Corn Belt regions.

Of the 41.8 million acres expected to go out of cropland, about 23.4 million acres is in classes I, II, and III. Another 8.7 million acres is in class IV, of which 5.9 million acres or about 54 percent is expected to be converted to pasture or range.

The Inventory indicates that about 9.6 million acres of cropland in classes V–VIII will be shifted to other agricultural uses. The largest part, 7.3 million acres, will go into pasture or range, the remaining 2.3 million acres to woodland and other uses.

**Land coming into cropland**

About 30.6 million acres is expected to be converted to cropland by 1975 (table 22). About 64 percent will come from pasture and range, 25 percent from forest and woodland, 7 percent from other land in private ownership, and 4 percent from Federal land coming into private ownership. All this new cropland will need preparation or treatment to put it into cultivation and establish the conservation measures required in its new use.

The new cropland will include land of all capability classes, about 28 million acres or 92 percent naturally suitable for cultivation with varying degrees of protection (classes I through IV) (table 22) but only about 1.8 million acres class I land.

*go out of cropland by 1975*

items listed and data may not check exactly with summary tables]

| To other land | | | | Out of agriculture | | | | | Total going out of cropland | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Class I-III | Class IV | Class V-VIII | Total | Class I-III | Class IV | Class V-VIII | Total | To urban uses | Class I-III | Class IV | Class V-VIII | Total |
| *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* |
| 421 | 133 | 96 | 650 | 889 | 87 | 41 | 1,016 | 912 | 2,421 | 696 | 523 | 3,640 |
| 264 | 123 | 82 | 469 | 921 | 133 | 45 | 1,099 | 1,073 | 1,650 | 776 | 513 | 2,939 |
| 334 | 68 | 87 | 489 | 2,048 | 139 | 71 | 2.258 | 2.017 | 3,453 | 1,070 | 1,539 | 6,062 |
| 51 | 5 | 21 | 79 | 450 | 36 | 28 | 514 | 302 | 2,111 | 1,274 | 2,405 | 5,790 |
| 168 | 43 | 42 | 252 | 383 | 64 | 25 | 472 | 365 | 2,091 | 920 | 1,009 | 4,020 |
| 138 | 49 | 19 | 206 | 309 | 93 | 24 | 426 | 363 | 3,151 | 844 | 365 | 4,360 |
| 128 | 4 | 3 | 135 | 174 | 5 | 3 | 182 | 144 | 2,690 | 422 | 412 | 3,524 |
| 50 | 12 | 10 | 72 | 438 | 25 | 40 | 503 | 382 | 3,728 | 1,444 | 1,353 | 6,525 |
| 80 | 28 | 10 | 118 | 367 | 76 | 32 | 475 | 425 | 1,032 | 949 | 1,332 | 3,313 |
| 81 | 20 | 12 | 113 | 897 | 116 | 23 | 1,036 | 985 | 1,106 | 347 | 147 | 1,600 |
| 1,716 | 485 | 382 | 2,583 | 6,876 | 774 | 332 | 7,981 | 6,968 | 23,434 | 8,741 | 9,598 | 41,773 |
| 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 2 |
| 0 | 0 | 0 | 0 | 6 | 1 | — | 7 | 7 | 8 | 4 | 5 | 17 |
| 1,716 | 485 | 382 | 2,583 | 6,883 | 775 | 332 | 7,989 | 6,975 | 23,443 | 8,745 | 9,604 | 41,792 |

TABLE 22.—*Land expected to*

[Because of rounding, some totals may not equal the sum of the

| Region | From pasture-range | | | | From forest-woodland | | | |
|---|---|---|---|---|---|---|---|---|
| | Class I-III | Class IV | Class V-VIII | Total | Class I-III | Class IV | Class V-VIII | Total |
| | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* |
| Northeast | 349 | 58 | 41 | 448 | 230 | 10 | 25 | 265 |
| Lake States | 1,379 | 94 | 37 | 1,510 | 642 | 70 | 12 | 724 |
| Corn Belt | 3,435 | 294 | 203 | 3,932 | 1,324 | 78 | 89 | 1,491 |
| Northern Plains | 2,856 | 345 | 127 | 3,328 | 138 | 3 | 15 | 156 |
| Appalachian | 760 | 129 | 92 | 981 | 1,052 | 133 | 43 | 1,228 |
| Southeast | 570 | 202 | 20 | 792 | 823 | 113 | 41 | 977 |
| Delta States | 374 | 18 | 9 | 401 | 1,219 | 63 | 28 | 1,310 |
| Southern Plains | 2,573 | 408 | 413 | 3,394 | 502 | 35 | 124 | 661 |
| Mountain | 1,927 | 750 | 640 | 3,317 | 143 | 40 | 102 | 285 |
| Pacific | 998 | 369 | 191 | 1,558 | 293 | 71 | 23 | 387 |
| U.S. mainland | 15,219 | 2,667 | 1,773 | 19,660 | 6,366 | 615 | 502 | 7,483 |
| Alaska | 0 | 0 | 0 | 0 | 51 | 6 | 0 | 57 |
| Hawaii | 0 | 3 | 3 | 6 | 7 | 7 | 11 | 25 |
| U.S. total | 15,220 | 2,670 | 1,776 | 19,666 | 6,424 | 628 | 513 | 7,565 |

[1] Less than 500 acres.

There will be an almost equal exchange of class I–III land between cropland and other uses. Class IV cropland will be reduced from 49.0 to 44.1 million acres.

A much larger acreage of classes V to VIII land is expected to go out of cropland than to come in; i.e., 9.6 and 2.5 million acres respectively. This will result in an overall reduction of about 28 percent in class V–VIII cropland by 1975.

Although significant reductions are expected in class IV, VI, and VII cropland, the Inventory indicates that nearly 60.6 million acres in these classes will still be in cultivation in 1975 (table 23). It is likely that a high proportion of this cropland will be used for specialty crops, such as orchard, small fruit, and vineyards. Even in these uses, these classes of land require especially intensive conservation treatment to prevent deterioration.

## CONSERVATION TREATMENT FOR CROPLAND

Conservation treatment of some kind is needed and feasible on about 272 million acres of cropland. This is about 62 percent of the 437 million acres expected to be in cropland in 1975 (fig. 33, table 24).

About 408 million acres or 93 percent of the total cropland has some conservation problem

TABLE 23.—*Land capability of expected cropland, 1975*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | Suitable for regular cultivation | | | | Suitable for limited cultivation | Generally not suitable for cultivation | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class I | Class II | Class III | Class I-III | Class IV | Class V | Class VI | Class VII | Class VIII | Class V-VIII | |
| | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* |
| Northeast | 1,107 | 8,339 | 5,813 | 15,259 | 2,116 | 2 | 607 | 140 | 12 | 761 | 18,136 |
| Lake States | 2,096 | 24,994 | 12,114 | 39,204 | 4,279 | 139 | 528 | 421 | 7 | 1,095 | 44,578 |
| Corn Belt | 6,319 | 53,253 | 26,274 | 85,846 | 5,657 | 354 | 1,703 | 907 | 23 | 2,988 | 94,490 |
| Northern Plains | 3,924 | 37,416 | 38,816 | 80,156 | 7,097 | 244 | 3,903 | 270 | 1 | 4,418 | 91,670 |
| Appalachian | 1,771 | 12,854 | 6,943 | 21,568 | 2,900 | 25 | 1,030 | 254 | 1 | 1,310 | 25,779 |
| Southeast | 1,574 | 9,101 | 5,793 | 16,468 | 1,495 | 78 | 152 | 58 | 1 | 289 | 18,252 |
| Delta States | 2,127 | 8,213 | 7,458 | 17,798 | 869 | 115 | 99 | 110 | — | 324 | 18,996 |
| Southern Plains | 4,582 | 22,403 | 20,618 | 47,603 | 4,582 | 662 | 770 | 333 | — | 1,765 | 53,950 |
| Mountain | 1,990 | 8,945 | 18,298 | 29,233 | 9,792 | 130 | 3,557 | 751 | 41 | 4,479 | 43,505 |
| Pacific | 2,452 | 8,643 | 9,632 | 20,727 | 5,271 | 20 | 755 | 54 | 1 | 829 | 26,828 |
| U.S. mainland | 27,942 | 194,160 | 151,760 | 373,862 | 44,058 | 1,770 | 13,105 | 3,299 | 86 | 18,260 | 436,185 |
| Alaska | 0 | 37 | 33 | 70 | 8 | 0 | 0 | 0 | 0 | 0 | 78 |
| Hawaii | 19 | 101 | 79 | 198 | 87 | −0 | 37 | 7 | −0 | 45 | 330 |
| U.S. total | 27,961 | 194,297 | 151,872 | 374,230 | 44,152 | 1,770 | 13,142 | 3,306 | 86 | 18,304 | 436,593 |

*come into cropland by 1975*

items listed and data may not check exactly with summary tables]

| From other land | | | | From public land | | | | Total new cropland | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Class I-III | Class IV | Class V-VIII | Total | Class I-III | Class IV | Class V-VIII | Total | Class I-III | Class IV | Class V-VIII | Total |
| *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* |
| 139 | 13 | 4 | 156 | — | — | — | — | 718 | 81 | 70 | 869 |
| 340 | 43 | 14 | 397 | — | — | — | — | 2,360 | 208 | 62 | 2,630 |
| 349 | 25 | 29 | 403 | 1 | (1) | — | 1 | 5,108 | 397 | 320 | 5,825 |
| 74 | 2 | 1 | 77 | 3 | (1) | (1) | 3 | 3,071 | 350 | 143 | 3,564 |
| 195 | 22 | 11 | 228 | (1) | — | — | (1) | 2,007 | 284 | 146 | 2,437 |
| 379 | 72 | 8 | 459 | — | — | — | — | 1,772 | 387 | 70 | 2,229 |
| 76 | 6 | 4 | 86 | — | — | — | — | 1,669 | 87 | 41 | 1,797 |
| 114 | 26 | 28 | 168 | 1 | — | — | 1 | 3,189 | 469 | 565 | 4,223 |
| 82 | 33 | 62 | 178 | 440 | 83 | 27 | 550 | 2,592 | 905 | 831 | 4,328 |
| 69 | 80 | (1) | 149 | 342 | 200 | 17 | 559 | 1,701 | 720 | 231 | 2,652 |
| 1,814 | 323 | 161 | 2,298 | 787 | 283 | 44 | 1,114 | 24,187 | 3,888 | 2,480 | 30,555 |
| 0 | 0 | 0 | (1) | — | — | — | — | 51 | 6 | 0 | 57 |
| 1 | 0 | 0 | 1 | — | — | — | — | 8 | 10 | 14 | 32 |
| 1,815 | 323 | 161 | 2,299 | 787 | 283 | 44 | 1,114 | 24,247 | 3,903 | 2,494 | 30,644 |

that limits its use. The dominant problems considered in the CNI are erosion hazard, excess water, unfavorable soil, and adverse climate. Only class I land, amounting to 28 million acres, has none of these.

About 136 million acres or 31 percent of the total cropland has been adequately treated for conservation and is protected from deterioration. This area and the 28 million acres of class I cropland total about 164 million acres not needing treatment—38 percent of the total cropland. It is land used within its capability and has all necessary treatment and management practices installed to meet a satisfactory level of production but not necessarily the maximum or optimum. The conservation treatments must be continued or maintained if the conservation needs of the land are to be met.

Although cropland acreages and land conditions vary widely by farm production regions, the proportions needing conservation treatment vary only slightly from region to region (fig. 33). The data show that 93 percent of the nation's cropland has a conservation problem, ranging from 89 percent in the Delta States and Pacific regions to 96 percent in the Northern Plains. Similarly, 62 percent of the Nation's cropland needs conservation treatment,

TABLE 24.—*Cropland needing conservation treatment by 1975*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | Total cropland 1975 | Having any problem | | Needing treatment | | Not needing treatment | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | No problem | | Adequately treated | |
| | *1,000 acres* | *1,000 acres* | *Percent* [1] | *1,000 acres* | *Percent* [1] | *1,000 acres* | *Percent* [1] | *1,000 acres* | *Percent* [1] |
| Northeast | 18,137 | 17,028 | 94 | 11,048 | 61 | 1,109 | 6 | 5,980 | 33 |
| Lake States | 44,578 | 42,482 | 95 | 29,890 | 67 | 2,096 | 5 | 12,592 | 28 |
| Corn Belt | 94,490 | 88,158 | 93 | 56,538 | 60 | 6,332 | 7 | 31,520 | 33 |
| Northern Plains | 91,670 | 87,554 | 96 | 59,323 | 65 | 4,116 | 4 | 28,231 | 31 |
| Appalachian | 25,779 | 24,008 | 93 | 16,475 | 64 | 1,771 | 7 | 7,533 | 29 |
| Southeast | 18,252 | 16,678 | 91 | 11,445 | 63 | 1,574 | 8 | 5,233 | 29 |
| Delta States | 18,996 | 16,864 | 89 | 11,332 | 60 | 2,133 | 11 | 5,532 | 29 |
| Southern Plains | 53,950 | 49,169 | 91 | 33,477 | 62 | 4,781 | 9 | 15,692 | 29 |
| Mountain | 43,505 | 41,457 | 95 | 26,154 | 60 | 2,048 | 5 | 15,303 | 35 |
| Pacific | 26,828 | 24,373 | 91 | 16,061 | 60 | 2,455 | 9 | 8,312 | 31 |
| U.S. mainland | 436,185 | 407,771 | 93 | 271,843 | 62 | 28,414 | 7 | 135,928 | 31 |
| Alaska | 78 | 78 | 100 | 49 | 63 | 0 | — | 29 | 37 |
| Hawaii | 329 | 311 | 95 | 188 | 57 | 18 | 6 | 123 | 37 |
| U.S. total | 436,592 | 408,160 | 93 | 272,080 | 62 | 28,432 | 7 | 136,080 | 31 |

[1] Of total cropland.

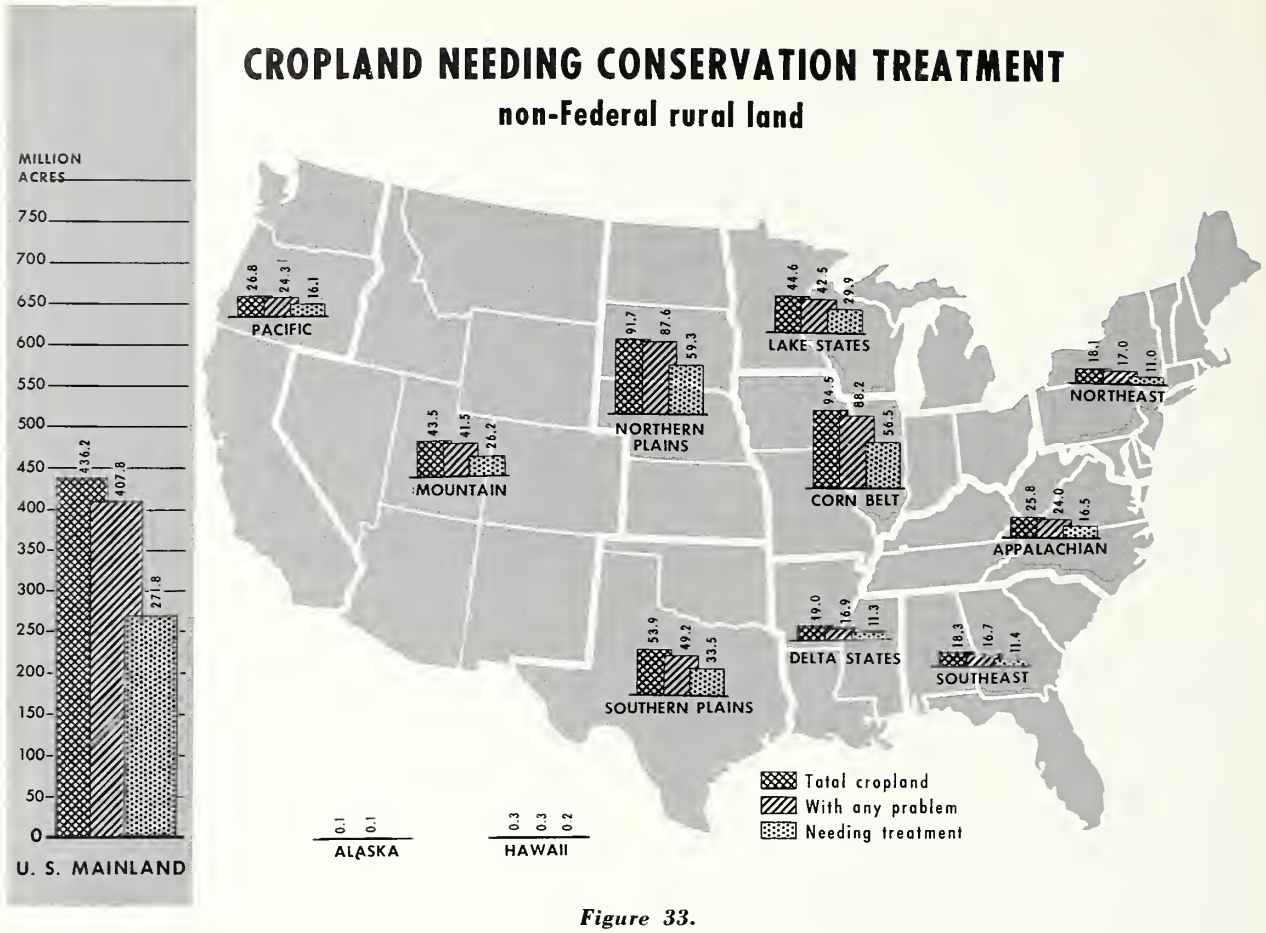


*Figure 33.*

TABLE 25.—*Conservation*

[Because of rounding, some totals may not equal the sum of the

| Region | Total cropland having any problem | Having problem of erosion | | | | | | Having problem of excess water | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Dominant [1] | | Secondary [1] | | Total [1] | | Dominant [1] | | Secondary [1] | | Total [1] | |
| | *1,000 acres* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* |
| Northeast | 17,028 | 11,060 | 65 | 3,044 | 18 | 14,104 | 83 | 4,298 | 25 | 2,978 | 17 | 7,276 | 43 |
| Lake States | 42,482 | 16,494 | 39 | 14,250 | 34 | 30,744 | 73 | 17,560 | 41 | 1,120 | 3 | 18,680 | 44 |
| Corn Belt | 88,158 | 44,211 | 50 | 6,612 | 8 | 50,823 | 58 | 39,784 | 45 | 7,119 | 8 | 46,903 | 53 |
| Northern Plains | 87,554 | 59,221 | 68 | 13,944 | 16 | 73,165 | 84 | 6,190 | 7 | 1,312 | 1 | 7,502 | 9 |
| Appalachian | 24,008 | 16,033 | 67 | 1,494 | 6 | 17,527 | 73 | 5,900 | 25 | 449 | (1) | 6,349 | 26 |
| Southeast | 16,678 | 9,239 | 55 | 3,546 | 21 | 12,785 | 77 | 2,544 | 15 | 1,147 | 7 | 3,691 | 22 |
| Delta States | 16,864 | 5,190 | 31 | 339 | (1) | 5,529 | 33 | 9,658 | 57 | 1,483 | 9 | 11,141 | 66 |
| Southern Plains | 49,169 | 34,801 | 71 | 3,476 | 7 | 38,277 | 78 | 3,313 | 7 | 150 | (2) | 3,463 | 7 |
| Mountain | 41,457 | 25,338 | 61 | 9,916 | 24 | 35,254 | 85 | 1,501 | 4 | 1,079 | 3 | 2,580 | 6 |
| Pacific | 24,373 | 12,279 | 50 | 2,113 | 9 | 14,392 | 59 | 3,665 | 15 | 1,164 | 5 | 4,829 | 20 |
| U.S. mainland | 407,771 | 233,865 | 57 | 58,733 | 14 | 292,598 | 72 | 94,413 | 23 | 18,000 | 4 | 112,413 | 28 |
| Alaska | 78 | 41 | 53 | 13 | 17 | 54 | 69 | 8 | 10 | 5 | 6 | 13 | 17 |
| Hawaii | 311 | 224 | 72 | 23 | 7 | 247 | 79 | 30 | 10 | 4 | 1 | 34 | 11 |
| U.S. total | 408,160 | 234,130 | 57 | 58,770 | 14 | 292,900 | 72 | 94,451 | 23 | 18,009 | 4 | 112,460 | 28 |

[1] Since all cropland having any problem was recorded as having one problem dominant but some had no secondary problem, the acreages and percents in the "dominant" columns total the "total cropland having any problem" and 100 percent; those in the "secondary" columns, less; and those in the "total" columns, more.

[2] Less than 0.5 percent.

ranging from 57 percent in Hawaii to 67 percent in the Lake States. The acreage needing treatment, however, varies greatly from region to region. The Corn Belt and Northern Plains have 56.5 and 59.3 million acres, respectively, needing treatment, but the Southeast and Delta regions each has only a little more than 11 million acres of cropland needing treatment.

The conservation treatment needs on cropland were defined in terms of dominant and secondary problems. The CNI did not attempt to determine amounts of specific practices needed but rather to indicate the extent of the fundamental hazards requiring attention. It was recognized that choices between alternative combinations of specific practices for each problem would vary widely because of changing economic conditions and developing technology.

About 408.2 (407.8) million acres of cropland has one or more of the four major problems that designate land-capability subclasses: erosion hazard, excess water, unfavorable soil, or adverse climate (table 25).

In the land-capability classification, the limitations that can be modified or corrected (erosion, excess water, and unfavorable soil) take precedence over adverse climate in determining subclasses.

Of the 408 million acres of cropland with problems, more than 234 million acres or 57 percent of the total has the hazard of erosion as the dominant problem. This is more than twice the 94 million acres having excess water as the dominant problem. Considerably less acreage has unfavorable soil and adverse climate as dominant problems. Thus, erosion is the most widespread conservation problem on cropland.

The dominant problems vary from one region to another. In the Southern Plains, Northern Plains, Appalachian, and Northeast regions, erosion hazard is the dominant problem on more than two-thirds of the total acreage. On the other hand, excess water is the most widespread problem in the Delta States and Lake States regions.

**Problems on cropland needing treatment**

Erosion is by far the most widespread conservation problem on cropland still needing treatment; it is the dominant problem on 161.6 (161.4) million acres or 60 percent and is the secondary one on an additional 39.5 million acres or 14 percent. This 201 million acres is 77 percent of the 272 million acres needing any treatment (table 26).

Unfavorable soil conditions is the second most extensive problem on cropland needing treatment. It is the dominant problem on 36.5 (36.4) million acres or 13 percent of the untreated cropland and is the secondary one on 45.3 million acres or 17 percent. A total of 81.8 (81.7) million acres needs treatment for unfavorable soil conditions. This problem is most important in the Southern Plains, Northern Plains, and Lake States regions.

Excess water affects about 72.5 (72.4) million acres or 27 percent of the untreated cropland. It is the dominant problem on 59.9 million acres or 22 percent of the cropland needing treatment and is the secondary one on 12.5 million acres or 5 percent. It is important in

*problems on cropland*

items listed and data may not check exactly with summary tables]

| Having problem of unfavorable soil | | | | | | Having problem of adverse climate | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Dominant [1] | | Secondary [1] | | Total [1] | | Dominant [1] | | Secondary [1] | | Total [1] | |
| *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* |
| 1,666 | 10 | 2,609 | 15 | 4,275 | 25 | 4 | 0 | 0 | 0 | 4 | 0 |
| 8,428 | 20 | 6,002 | 14 | 14,430 | 34 | 0 | — | 3,029 | 7 | 3,029 | 7 |
| 4,162 | 5 | 9,999 | 11 | 14,161 | 16 | 0 | — | 0 | — | 0 | — |
| 8,733 | 10 | 8,023 | 9 | 16,756 | 19 | 13,410 | 15 | 9,445 | 11 | 22,855 | 26 |
| 2,075 | 9 | 5,295 | 22 | 7,370 | 31 | 0 | — | 0 | — | 0 | — |
| 4,895 | 29 | 2,667 | 16 | 7,562 | 45 | 0 | — | 0 | — | 0 | — |
| 2,016 | 12 | 6,169 | 37 | 8,185 | 49 | 0 | — | 0 | — | 0 | — |
| 5,183 | 11 | 14,827 | 30 | 20,010 | 41 | 5,873 | 12 | 9,461 | 19 | 15,334 | 31 |
| 9,838 | 24 | 4,675 | 11 | 14,513 | 35 | 4,780 | 12 | 17,497 | 42 | 22,277 | 54 |
| 8,124 | 33 | 5,588 | 23 | 13,712 | 56 | 306 | 1 | 811 | 3 | 1,117 | 5 |
| 55,121 | 14 | 65,854 | 16 | 120,975 | 30 | 24,373 | 6 | 40,244 | 10 | 64,617 | 16 |
| 23 | 29 | 0 | — | 23 | 29 | 7 | 9 | 53 | 68 | 60 | 77 |
| 47 | 15 | 22 | 7 | 69 | 22 | 18 | 6 | 16 | 5 | 34 | 11 |
| 55,191 | 14 | 65,876 | 16 | 121,067 | 30 | 24,397 | 6 | 40,312 | 10 | 64,711 | 16 |

TABLE 26.—*Conservation problems*

[Because of rounding, some totals may not equal the sum of the

| Region | Total cropland needing treatment | Having problem of erosion | | | | | | Having problem of excess water | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Dominant [1] | | Secondary [1] | | Total [1] | | Dominant [1] | | Secondary [1] | | Total [1] | |
| | *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *Per-cent* | *1,000 acres* | *Per-cent* | *1,000 acres* | *Per-cent* | *1,000 acres* | *Per-cent* | *1,000 acres* | *Per-cent* |
| Northeast | 11,048 | 7,315 | 66 | 1,992 | 18 | 9,307 | 84 | 2,769 | 25 | 1,984 | 18 | 4,753 | 43 |
| Lake States | 29,890 | 11,224 | 38 | 10,548 | 35 | 21,772 | 73 | 12,558 | 42 | 937 | 3 | 13,495 | 45 |
| Corn Belt | 56,638 | 31,361 | 55 | 4,531 | 8 | 35,892 | 63 | 22,800 | 40 | 4,931 | 9 | 27,731 | 49 |
| Northern Plains | 59,323 | 42,304 | 71 | 9,185 | 15 | 51,489 | 86 | 3,541 | 6 | 784 | 1 | 4,325 | 7 |
| Appalachian | 16,475 | 10,981 | 67 | 1,069 | 6 | 12,050 | 73 | 4,156 | 25 | 297 | 2 | 4,453 | 27 |
| Southeast | 11,445 | 6,150 | 54 | 2,557 | 22 | 8,707 | 76 | 1,735 | 15 | 856 | 8 | 2,591 | 23 |
| Delta States | 11,332 | 3,450 | 30 | 242 | 2 | 3,692 | 33 | 6,531 | 58 | 1,003 | 9 | 7,534 | 67 |
| Southern Plains | 33,477 | 23,936 | 72 | 1,827 | 5 | 25,763 | 77 | 2,468 | 7 | 117 | 1 | 2,585 | 8 |
| Mountain | 26,154 | 16,032 | 61 | 6,075 | 23 | 22,107 | 84 | 1,031 | 4 | 758 | 3 | 1,789 | 7 |
| Pacific | 16,061 | 8,649 | 54 | 1,476 | 9 | 10,125 | 63 | 2,319 | 14 | 857 | 5 | 3,176 | 20 |
| U.S. mainland | 271,843 | 161,402 | 60 | 39,502 | 14 | 200,904 | 74 | 59,908 | 22 | 12,524 | 5 | 72,449 | 27 |
| Alaska | 49 | 30 | 61 | 12 | 25 | 42 | 86 | 7 | 14 | 5 | 10 | 12 | 24 |
| Hawaii | 188 | 150 | 80 | 15 | 8 | 165 | 87 | 10 | 5 | 4 | 2 | 14 | 7 |
| U.S. total | 272,080 | 161,582 | 60 | 39,529 | | 201,111 | 77 | 59,925 | 22 | 12,533 | 17 | 72,475 | 27 |

[1] Since all cropland having any problem was recorded as having one problem dominant but some had no secondary problem, the acreages and percents in the "dominant" columns total the "total cropland having any problem" and 100 percent; those in the "secondary" columns, less; and those in the "total" columns, more.

TABLE 27.—*Cropland needing*

[Because of rounding, some totals may not equal the sum of the

| Region | Cropland having erosion the dominant problem | | | | | | Cropland having erosion |
|---|---|---|---|---|---|---|---|
| | | | | No secondary problem | | | Excess water |
| | Total | Needing treatment | | Total | Needing treatment | | Total |
| | *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* |
| Northeast | 11,060 | 7,315 | 66 | 5,941 | 3,864 | 65 | 2,911 |
| Lake States | 16,494 | 11,224 | 68 | 11,793 | 7,710 | 65 | 1,095 |
| Corn Belt | 44,211 | 31,361 | 71 | 34,056 | 24,111 | 71 | 6,737 |
| Northern Plains | 59,221 | 42,304 | 71 | 42,725 | 30,527 | 71 | 827 |
| Appalachian | 16,033 | 10,981 | 68 | 11,376 | 7,772 | 68 | 315 |
| Southeast | 9,239 | 6,150 | 67 | 7,180 | 4,831 | 67 | 499 |
| Delta States | 5,190 | 3,450 | 66 | 3,853 | 2,494 | 65 | 69 |
| Southern Plains | 34,801 | 23,936 | 69 | 13,571 | 9,240 | 68 | 121 |
| Mountain | 25,338 | 16,032 | 63 | 4,625 | 3,236 | 70 | 91 |
| Pacific | 12,279 | 8,649 | 70 | 7,994 | 5,455 | 68 | 171 |
| U.S. mainland | 233,865 | 161,402 | 69 | 143,114 | 99,223 | 69 | 12,835 |
| Alaska | 41 | 30 | 73 | 0 | 0 | 0 | 5 |
| Hawaii | 224 | 150 | 67 | 187 | 120 | 64 | 4 |
| U.S. total | 234,130 | 161,582 | 69 | 143,301 | 99,343 | 69 | 12,844 |

| Region | Excess water | | |
|---|---|---|---|
| | Needing treatment | | |
| | *1,000 acres* | *Per-cent* | |
| Northeast | 1,943 | 67 | |
| Lake States | 920 | 84 | |
| Corn Belt | 4,779 | 71 | |
| Northern Plains | 515 | 62 | |
| Appalachian | 213 | 68 | |
| Southeast | 317 | 64 | |
| Delta States | 42 | 61 | |
| Southern Plains | 93 | 77 | |
| Mountain | 72 | 79 | |
| Pacific | 89 | 52 | |
| U.S. mainland | 8,982 | 70 | |
| Alaska | 5 | 100 | |
| Hawaii | 4 | 100 | |
| U.S. total | 8,991 | 70 | |

the Corn Belt, Lake States, and Delta States regions.

Adverse climate is a conservation problem on about 40.9 (40.7) million acres or 15 percent of cropland needing treatment but is not the major dominant problem in any region. It is a secondary problem, however, on considerable acreages in the Northern Plains, Southern Plains, and Mountain regions.

The relationships of the various problems needing treatment emphasize the importance of erosion hazard and unfavorable soil conditions in the total conservation job ahead. Both problems require recurring annual practices to prevent further deterioration.

Considering both dominant and secondary problems on cropland still needing treatment, about 51 percent of the conservation work ahead is concerned with erosion, 18 percent with excess water, 21 percent with unfavorable soil conditions, and 10 percent with adverse climate.

**Erosion.** Erosion by water or wind is the dominant problem on 234.1 (233.9) million acres of cropland, of which 161.6 (161.4) million acres or 69 percent is not treated and is

*on cropland needing treatment*

items listed and data may not check exactly with summary tables]

| Having problem of unfavorable soil | | | | | | Having problem of adverse climate | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Dominant [1] | | Secondary [1] | | Total [1] | | Dominant [1] | | Secondary [1] | | Total [1] | |
| *1,000 acres* | *Per-cent* | *1,000 acres* | *Per-cent* | *1,000 acres* | *Per-cent* | *1,000 acres* | *Per-cent* | *1,000 acres* | *Per-cent* | *1,000 acres* | *Per-cent* |
| 960 | 9 | 1,769 | 16 | 2,729 | 25 | 3 | — | — | — | 3 | — |
| 6,108 | 20 | 4,080 | 14 | 10,188 | 34 | — | — | 2,164 | 7 | 2,164 | 7 |
| 2,477 | 4 | 6,546 | 12 | 9,023 | 16 | — | — | — | — | — | — |
| 5,605 | 10 | 5,520 | 9 | 11,125 | 19 | 7,873 | 13 | 6,886 | 12 | 14,759 | 25 |
| 1,339 | 8 | 3,655 | 22 | 4,994 | 30 | — | — | — | — | — | — |
| 3,560 | 31 | 1,831 | 16 | 5,391 | 47 | — | — | — | — | — | — |
| 1,351 | 12 | 4,194 | 37 | 5,545 | 49 | — | — | — | — | — | — |
| 3,732 | 11 | 10,631 | 32 | 14,363 | 43 | 3,341 | 10 | 6,489 | 19 | 9,830 | 29 |
| 6,298 | 24 | 3,188 | 12 | 9,486 | 36 | 2,793 | 11 | 10,520 | 40 | 13,313 | 51 |
| 5,005 | 31 | 3,892 | 24 | 8,897 | 55 | 89 | 1 | 643 | 4 | 732 | 5 |
| 36,434 | 13 | 45,306 | 17 | 81,740 | 30 | 14,099 | 5 | 26,702 | 10 | 40,701 | 15 |
| 12 | 25 | — | 0 | 12 | 24 | — | — | 32 | 65 | 32 | 65 |
| 17 | 8 | 15 | 8 | 32 | 17 | 12 | 7 | 15 | 8 | 27 | 14 |
| 36,463 | 13 | 45,134 | 17 | 81,774 | 30 | 14,111 | 5 | 26,749 | 10 | 40,860 | 15 |

*treatment for problem of erosion*

items listed and data may not check exactly with summary tables]

| the dominant problem and a secondary problem of— | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unfavorable soil | | | Adverse climate | | | Cropland having erosion the secondary problem | | | Cropland having any problem of erosion | | |
| Total | Needing treatment | | Total | Needing treatment | | Total | Needing treatment | | Total | Needing treatment | |
| *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *1,000 acres* | *Per-cent* |
| 2,208 | 1,509 | 68 | 0 | 0 | — | 3,044 | 1,992 | 65 | 14,104 | 9,307 | 66 |
| 1,310 | 853 | 65 | 2,297 | 1,741 | 26 | 14,250 | 10,548 | 74 | 30,744 | 21,772 | 71 |
| 3,419 | 2,469 | 72 | 0 | 0 | 0 | 6,612 | 4,531 | 69 | 50,823 | 35,892 | 71 |
| 7,062 | 4,957 | 70 | 8,606 | 6,305 | 73 | 13,944 | 9,185 | 66 | 73,165 | 51,489 | 70 |
| 4,342 | 2,996 | 69 | 0 | 0 | 0 | 1,494 | 1,069 | 72 | 17,527 | 12,050 | 69 |
| 1,560 | 1,021 | 65 | 0 | 0 | 0 | 3,546 | 2,557 | 72 | 12,785 | 8,707 | 68 |
| 1,268 | 914 | 72 | 0 | 0 | 0 | 339 | 242 | 71 | 5,529 | 3,692 | 67 |
| 12,162 | 8,496 | 70 | 8,947 | 6,108 | 68 | 3,476 | 1,827 | 53 | 38,277 | 25,763 | 67 |
| 3,844 | 2,632 | 68 | 16,778 | 10,093 | 60 | 9,916 | 6,075 | 61 | 35,254 | 22,107 | 63 |
| 3,467 | 2,558 | 74 | 647 | 547 | 85 | 2,113 | 1,476 | 70 | 14,392 | 10,125 | 70 |
| 40,642 | 28,404 | 70 | 37,276 | 24,794 | 67 | 58,733 | 39,503 | 67 | 292,598 | 200,905 | 69 |
| 0 | 0 | 0 | 35 | 25 | 71 | 13 | 12 | 92 | 54 | 42 | 78 |
| 19 | 12 | 63 | 14 | 14 | 100 | 23 | 15 | 65 | 247 | 165 | 67 |
| 40,661 | 28,415 | 70 | 37,325 | 24,833 | 67 | 58,770 | 39,531 | 67 | 292,900 | 201,113 | 69 |

feasible to treat. Of the cropland needing treatment for erosion, 62.2 million acres also has a secondary problem of excess water, unfavorable soil, or adverse climate, (table 27).

In addition, erosion is a secondary problem on 58.8 (58.7) million acres of cropland. About 39.5 million acres of this needs treatment, bringing to 201.1 (200.9) million acres the cropland that requires treatment to reduce excessive soil losses. This is about 73 percent of the total acreage of cropland needing treatment.

The CNI does not specifically point out the need for fertilizer and lime, but the annual losses from erosion in terms of replacing nitrogen and phosphorous through commercial fertilizers would amount to more than 4 billion dollars.[4] Virtually every acre of cropland in the country needs fertilizer except some in parts of the dryland farming area of the Great Plains and West. Continued applications of lime or other soil amendments are needed in the humid sections of the country and areas where salinity or alkalinity are problems.

[4] Estimates of "Losses in Agriculture" by Agricultural Research Service. In preparation.

TABLE 28.—*Prevailing type of erosion on cropland, 1958*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | Cropland having erosion as the dominant problem | Water erosion | | | | Wind erosion | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Cropland having problem | | Needing treatment | | Cropland having problem | | Needing treatment | |
| | *1,000 acres* | *1,000 acres* | *Percent* [1] | *1,000 acres* | *Percent* [2] | *1,000 acres* | *Percent* [1] | *1,000 acres* | *Percent* [2] |
| Northeast | 11,060 | 10,721 | 97 | 7,175 | 67 | 339 | 3 | 140 | 41 |
| Lake States | 16,494 | 15,348 | 93 | 10,479 | 68 | 1,146 | 7 | 745 | 65 |
| Corn Belt | 44,211 | 44,088 | 100 | 31,269 | 71 | 123 | ([3]) | 92 | 75 |
| Northern Plains | 59,221 | 35,959 | 61 | 26,580 | 74 | 23,262 | 39 | 15,724 | 68 |
| Appalachian | 16,033 | 15,183 | 95 | 10,201 | 67 | 850 | 5 | 780 | 92 |
| Southeast | 9,239 | 9,017 | 98 | 6,036 | 67 | 222 | 2 | 114 | 51 |
| Delta States | 5,190 | 5,190 | 100 | 3,450 | 66 | 0 | — | 0 | — |
| Southern Plains | 34,801 | 22,933 | 66 | 16,186 | 70 | 11,868 | 34 | 7,750 | 65 |
| Mountain | 25,338 | 10,433 | 41 | 6,682 | 64 | 14,905 | 59 | 9,350 | 63 |
| Pacific | 12,279 | 10,215 | 83 | 7,189 | 70 | 2,064 | 17 | 1,460 | 71 |
| U.S. mainland | 233,865 | 179,087 | 77 | 125,247 | 70 | 54,779 | 23 | 36,128 | 66 |
| Alaska | 41 | 38 | 93 | 30 | 73 | 3 | 7 | 1 | 33 |
| Hawaii | 224 | 221 | 99 | 150 | 67 | 3 | 1 | 2 | 67 |
| U.S. total | 234,130 | 179,346 | 77 | 125,427 | 70 | 54,785 | 23 | 36,131 | 66 |

[1] Of total cropland having erosion as the dominant problem.
[2] Of cropland having erosion of the type indicated.
[3] Less than 1 percent.

The proportion of cropland with erosion as a dominant problem that needs conservation treatment varies only slightly by regions. The National average is 69 percent, and the regions ranged from 63 in the Mountain region to 71 in the Corn Belt and the Northern Plains

There is, however, considerable variation between regions in the acreage needing treatment for the secondary problems on cropland with a dominant problem of erosion.

More than three-fourths of the cropland with erosion as the dominant problem is affected primarily by water erosion (fig. 34); less than one-fourth by wind erosion. Of 179.3 (179.1) million acres with a dominant problem of water erosion, 125.4 (125.2) million still needs treatment (table 28).

ORE-75166

*Figure 34.*—**Water erosion is the principal hazard on three-fourths of the cropland with erosion as the dominant conservation problem.**

Wind erosion is the dominant erosion problem on an estimated 54.8 million acres or about 23 percent of the total acreage having an erosion problem. Of this amount, about 36.1 million acres need treatment.

Six States—Colorado, Delaware, Montana, New Mexico, and North and South Dakota—report more acres affected by wind than by water.[5] In addition, in parts of Kansas, Nebraska, Oklahoma, Texas and Wyoming, wind erosion affects more land than does water erosion. In the Southern and Northern Plains States and in Colorado, Montana, New Mexico and Wyoming, there are 32.6 million acres on which wind erosion is the dominant problem. This is 41 percent of the total acreage that has an erosion problem in these States, or 29 percent of the total cropland acreage needing treatment in the area.

**Treatment measures.** Many measures can be used on cropland to reduce serious soil losses from runoff. Basically they center around conservation cropping systems that use not only crops in a well-planned sequence, but combine this with crop-residue management, the needed fertilizer and lime, and a good water disposal system.

On some areas, adequate treatment can be

[5] Supplementary unpublished data.

achieved with nothing more than a suitable crop rotation, although the intensity of cropland use today limits reliance on rotation alone to control erosion. It is necessary to design conservation cropping systems that embody essential practices to protect the soil and that fit the farmer's needs for economical crop production. Some systems may include crop rotations containing perennial grasses and legumes, stripcropping, and grassed waterways (fig. 35); others may include terraces (fig. 36) and a specified crop sequence; while still others may include a crop sequence with the use of crop residues on the soil surface for protection during critical erosion periods.

Millions of acres of cropland have irregularly undulating topography that makes it impossible to construct terraces or diversions or to lay out practical contour tillage patterns. In these circumstances, it is necessary to rely on a cropping system that includes varying proportions and grasses and legumes in the sequence, the use of crop residues on the surface of the soil during critical erosion periods, proper tillage methods, and grassed waterways to achieve adequate conservation treatment of the land.

Research has provided information making it possible to devise many combinations of crop sequences and supporting management and mechanical practices that reduce soil losses to acceptable amounts. This information is being used in the 37 Eastern States as a guide in developing cropping systems for treating soils with an erosion hazard.

The conservation treatment of cropland where wind erosion is the major problem requires different measures than the more widespread problem of water erosion. In the Northern and Southern Plains regions, where most of the wind erosion occurs, the major reliance is on cultural and management measures that can be used with crops and their residues. This is a year-by-year application of the principle of providing cover on the land when high velocity winds are expected.

Much of the 54.6 million acres in the Great Plains States that has a problem of wind erosion is in areas where the land is fallowed every other year or once in 3 years. About 12 to 15 million acres needs a protective cover of crop residues each year when the land is not supporting a growing crop. Wheatland that is fallowed for one season is without a living cover for about 15 consecutive months between crops in the winter-wheat belt and as much as 20 to 21 months in the spring-wheat belt. Stubble-mulch farming is the principal practice to provide protection on fallowed land. Stubble mulching is a year-round job, and many farmers need information on how to adjust and use tillage equipment to leave an effective amount of residues on the surface of the soil. Land that is affected by wind erosion should never be considered as permanently treated, for this problem is present each time the land is in the fallow period. In the Northern and Southern Plains guides have been developed to determine the combinations of control measures that will effectively reduce soil losses from high-velocity winds.

Wind stripcropping and tree shelterbelts are used in some areas to give added protection from wind erosion (fig. 37). Alternating strips of grain and fallow, or of grain and row crops, are alined across the direction of prevailing winds; shelterbelts further break the sweep of the wind across the fields.

Wind erosion in the humid areas of the country is somewhat less serious than in the Great Plains. Nevertheless, it does create problems locally, particularly on cultivated organic and sandy soils. Crop residues, cover crops, wind stripcropping, and shelterbelts are measures that can be used to prevent serious wind erosion. Vegetable crops and small fruits grown on soils subject to blowing need added vegetative protection to prevent crop damage

MINN-1757

*Figure 35.*—A grassed waterway along the side of a field carries runoff water from the ends of contour rows and terraces to a natural drainageway.

IA-2707

*Figure 36.*—A terrace system on a sloping field provides protection from water erosion when used with a conservation cropping system.

SD-600

*Figure 37.*—**Tree shelterbelts and wind stripcropping are used in combination in the Great Plains to reduce wind erosion.**

as well as loss of soil. Temporary barriers that require the minimum of space on the high value cropland may be needed rather than shelterbelts.

Several million acres are also damaged by both wind and water erosion. This necessitates planning and applying both water-control and wind-control measures. In many places this requires terraces to reduce runoff and crop management measures to reduce soil blowing.

**Excess water.** Too much water, either on the surface or in the soil profile, is the dominant problem on about 94.4 million acres of cropland, (table 29). This condition prevails where soil characteristics prevent water from moving through the soil rapidly enough to permit good crop growth or where the surface is so flat or depressed that excess seasonal rainfall will not drain off fast enough without damage to the growing crop.

About 59.9 million acres or 63 percent of the cropland with excess water as the dominant problem needs treatment. In addition excess water is a secondary problem on 18 million acres, of which 12.5 million acres needs treatment.

On 55 million acres, excess water is the only conservation problem of consequence; 33 million acres or 60 percent of this cropland needs treatment. Secondary problems of erosion, unfavorable soil, or adverse climate occur with the dominant problem of excess water on 39.3 million acres.

The Lake States and Corn Belt have 59 percent of the Nation's cropland that has water as a dominant problem. This problem accounts for about 40 percent of the total acres needing treatment in those States. Excess water is a minor problem in the Mountain, Northern Plains, and Southern Plains regions, accounting for only about 6 percent of the total cropland needing treatment. The Delta States and Lake States have more cropland needing treatment because of excess water than because of erosion; 6.5 million to 3.4 million acres in the Delta States and 12.5 million to 11.2 million in the Lake States.

Wet areas have poor air and water relationships. It is important, therefore, that the soil

TABLE 29.—*Cropland needing treat*

[Because of rounding, some totals may not equal the sum of the

| Region | Cropland having excess water as the dominant problem | | | | | | | | | Cropland having excess |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | No secondary problem | | | Erosion hazard | | | |
| | Total | Needing treatment | | Total | Needing treatment | | Total | Needing treatment | | |
| | *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *1,000 acres* | *Per-cent* | |
| Northeast | 4,298 | 2,769 | 64 | 2,163 | 1,326 | 61 | 1,734 | 1,183 | 68 | |
| Lake States | 17,560 | 12,558 | 72 | 5,473 | 4,020 | 73 | 6,663 | 4,889 | 73 | |
| Corn Belt | 39,784 | 22,800 | 57 | 29,729 | 16,173 | 54 | 3,475 | 2,551 | 73 | |
| Northern Plains | 6,190 | 3,541 | 57 | 3,869 | 2,176 | 56 | 1,431 | 873 | 61 | |
| Appalachian | 5,900 | 4,156 | 70 | 4,902 | 3,466 | 71 | 44 | 31 | 70 | |
| Southeast | 2,544 | 1,735 | 68 | 1,409 | 908 | 64 | 28 | 17 | 61 | |
| Delta States | 9,658 | 6,531 | 68 | 4,628 | 3,152 | 68 | 130 | 99 | 76 | |
| Southern Plains | 3,313 | 2,468 | 74 | 1,440 | 934 | 65 | 12 | 7 | 58 | |
| Mountain | 1,501 | 1,031 | 69 | 515 | 388 | 75 | 202 | 140 | 69 | |
| Pacific | 3,665 | 2,319 | 63 | 960 | 586 | 61 | 454 | 316 | 70 | |
| U.S. mainland | 94,413 | 59,908 | 63 | 55,088 | 33,128 | 60 | 14,172 | 10,107 | 71 | |
| Alaska | 8 | 7 | 88 | (1) | (1) | — | (1) | (1) | 0 | |
| Hawaii | 22 | 10 | 45 | 15 | 4 | 27 | 3 | 3 | 100 | |
| U.S. total | 94,443 | 59,925 | 63 | 55,103 | 33,132 | 60 | 14,175 | 10,110 | 71 | |

[1] Less than 500 acres.

be kept as permeable as possible so that water can move through readily. They need good cropping systems that make maximum use of such practices as proper and timely tillage, growing of grasses and deep-rooted legumes, management of crop residues, and use of soil amendments. This will aid in keeping the permanent water-disposal system in good operating condition.

Surface or subsurface drains are needed on nearly all the 59.9 million acres needing treatment where excess water is the major problem. Dikes and interception ditches will be needed for some areas to prevent inundation. Some areas will require land smoothing to prevent small pockets of water that impair crop production.

Excess water problems are generally caused by level or depressed topography, slowly permeable soils, and inadequate natural streams. Usually, the first step is to provide community drainage systems which will provide an adequate outlet for farm tile and surface drains. Many existing community systems need to be rehabilitated as a first step in removing excess water.

Farm-drainage systems include tile and open-ditch drains. Tile drains are used to remove subsurface water and to control the water table; surface drainage systems use shallow ditches to remove excess runoff.

Land grading for improved drainage is a recent practice that is increasing in importance. This practice eliminates the shallow ponds, 1 to 6 inches deep, that form after heavy rains.

Many of the wet areas require dikes (or levees) to prevent overflow from adjoining streams or lakes. The removal of excess water is a major problem in the Delta States.

In the Northeast, Appalachian, and Southeast regions there are many wet hillsides which need to be drained by subsurface interceptors. Detailed investigations are required to place an interceptor at the right location, but often one line of tile will serve a large wet area.

Soils that have both erosion and water problems need treatment for both. The treatments will vary in different parts of the country, but the basic principle is to remove excess surface water without causing excessive soil loss. Where row crops are used, it is often necessary to provide row drainage to prevent the excess water from hampering tillage and harvesting operations. Some soils require shallow surface ditches to collect and remove the water as rapidly as possible to help maintain proper air and water relationships in the root zone. Others with excess internal water require random tile lines to eliminate the wet areas.

**Unfavorable soil conditions.** Unfavorable soil is the dominant problem on about 55 million acres of cropland, of which more than 36 million or 66 percent needs treatment (table 30). This is the only major problem on 19.0 million acres, of which nearly 12 million needs treatment. It is the secondary problem on about 45 million acres of additional cropland needing treatment where other problems are dominant.

There are several soil characteristics that restrict plant growth in the root zone and present hazards or limitations to land use. These

*ment for problem of excess water*

items listed and data may not check exactly with summary tables]

| water as the dominant problem and a secondary problem of— | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unfavorable soil | | | Adverse climate | | | Cropland having excess water as the secondary problem | | | Cropland having any problem of excess water | | |
| Total | Needing treatment | | Total | Needing treatment | | Total | Needing treatment | | Total | Needing treatment | |
| *1,000 acres* | *1,000 acres* | *Percent* | *1,000 acres* | *1,000 acres* | *Percent* | *1,000 acres* | *1,000 acres* | *Percent* | *1,000 acres* | *1,000 acres* | *Percent* |
| 401 | 260 | 65 | 0 | 0 | — | 2,978 | 1,984 | 67 | 7,276 | 4,753 | 65 |
| 4,692 | 3,227 | 69 | 732 | 432 | 58 | 1,120 | 937 | 84 | 18,680 | 13,495 | 72 |
| 6,580 | 4,077 | 62 | 0 | 0 | — | 7,119 | 4,931 | 69 | 46,903 | 27,731 | 59 |
| 879 | 481 | 55 | 11 | 10 | 91 | 1,312 | 784 | 60 | 7,502 | 4,325 | 58 |
| 953 | 659 | 69 | 0 | 0 | — | 449 | 297 | 66 | 6,349 | 4,453 | 70 |
| 1,107 | 810 | 73 | 0 | 0 | — | 1,147 | 856 | 75 | 3,691 | 2,591 | 70 |
| 4,901 | 3,280 | 67 | 0 | 0 | — | 1,483 | 1,003 | 68 | 11,141 | 7,534 | 68 |
| 1,861 | 1,527 | 82 | 0 | 0 | — | 150 | 117 | 78 | 3,463 | 2,585 | 75 |
| 658 | 428 | 65 | 127 | 74 | 58 | 1,079 | 758 | 70 | 2,580 | 1,789 | 69 |
| 2,120 | 1,334 | 63 | 131 | 83 | 63 | 1,664 | 857 | 52 | 5,329 | 3,176 | 60 |
| 24,152 | 16,083 | 67 | 1,001 | 590 | 59 | 18,000 | 12,522 | 70 | 112,413 | 72,430 | 64 |
| 0 | 0 | 0 | 8 | 7 | 87 | 5 | 5 | 100 | 13 | 12 | 92 |
| 3 | 3 | 100 | 0 | 0 | 0 | 4 | 4 | 100 | 26 | 14 | 54 |
| 24,155 | 16,086 | 67 | 1,009 | 597 | 59 | 18,009 | 12,532 | 70 | 112,452 | 72,457 | 64 |

TABLE 30.—*Cropland needing treatment*

[Because of rounding, some totals may not equal the sum of the

| Region | Cropland having unfavorable soil as the dominant problem | | | | | | Cropland having unfavorable | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | No secondary problem | | | Erosion hazard | | |
| | Total | Needing treatment | | Total | Needing treatment | | Total | Needing treatment | |
| | *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *1,000 acres* | *Per-cent* |
| Northeast | 1,666 | 960 | 58 | 292 | 114 | 39 | 1,309 | 808 | 62 |
| Lake States | 8,428 | 6,108 | 72 | 815 | 433 | 53 | 7,587 | 5,659 | 75 |
| Corn Belt | 4,162 | 2,477 | 60 | 643 | 344 | 53 | 3,137 | 1,980 | 63 |
| Northern Plains | 8,733 | 5,605 | 64 | 3,213 | 1,924 | 60 | 4,307 | 2,887 | 67 |
| Appalachian | 2,075 | 1,339 | 64 | 492 | 216 | 44 | 1,450 | 1,083 | 75 |
| Southeast | 4,895 | 3,560 | 73 | 728 | 480 | 66 | 3,518 | 2,540 | 72 |
| Delta States | 2,016 | 1,351 | 67 | 393 | 247 | 63 | 209 | 143 | 68 |
| Southern Plains | 5,183 | 3,732 | 72 | 4,427 | 3,192 | 72 | 213 | 134 | 63 |
| Mountain | 9,838 | 6,298 | 64 | 2,348 | 1,622 | 69 | 5,981 | 3,684 | 62 |
| Pacific | 8,124 | 5,005 | 62 | 5,577 | 3,142 | 56 | 1,543 | 1,099 | 71 |
| U.S. mainland | 55,121 | 36,434 | 66 | 18,928 | 11,714 | 62 | 29,255 | 19,972 | 68 |
| Alaska | 23 | 12 | 52 | 0 | 0 | — | 13 | 12 | 92 |
| Hawaii | 47 | 17 | 36 | 40 | 13 | 32 | 5 | 2 | 40 |
| U.S. total | 55,190 | 36,463 | 66 | 18,969 | 11,727 | 62 | 29,273 | 19,987 | 68 |

include low moisture-holding capacity, stoniness, shallowness to layers that limits root development, acidity, salinity, alkalinity, and low fertility that is difficult to correct. The importance of the different limitations varies in different regions.

Treatment for unfavorable soil conditions, either as a dominant or secondary problem, is needed on about 81.7 million acres. This is second only to erosion in number of acres affected.

Salinity or alkalinity is a problem on 6.7 million acres. About 90 percent of this occurs in the Northern Plains, Mountain, and Pacific regions. In these regions about 70 percent of the soils with this problem need treatment. Since salinity and alkalinity cannot be completely eliminated, this land is never permanently treated and it is necessary to rely on recurring cultural and management measures that lessen the harmful effects of the soil conditions. These measures should be aimed to keep the soil open so that water can pass through it to leach out the salts. Grasses and legumes help accomplish this. Farmers can also grow salt-tolerant crops. Soil amendments are also needed on nearly all the acreages affected. Subsurface drainage will be beneficial

TABLE 31.—*Cropland needing treatment*

[Because of rounding, some totals may not equal the sum of the

| Region | Cropland having adverse climate as the dominant problem | | | | | | Cropland having adverse | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | No secondary problem | | | Erosion hazard | | |
| | Total | Needing treatment | | Total | Needing treatment | | Total | Needing treatment | |
| | *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *1,000 acres* | *Per-cent* |
| Northeast | 4 | 3 | 75 | 0 | 0 | — | 1 | 1 | 100 |
| Lake States | 0 | 0 | — | 0 | 0 | — | 0 | 0 | — |
| Corn Belt | 0 | 0 | — | 0 | 0 | — | 0 | 0 | — |
| Northern Plains | 13,410 | 7,873 | 59 | 5,023 | 2,321 | 46 | 8,206 | 5,425 | 66 |
| Appalachian | 0 | 0 | — | 0 | 0 | — | 0 | 0 | — |
| Southeast | 0 | 0 | — | 0 | 0 | — | 0 | 0 | — |
| Delta States | 0 | 0 | — | 0 | 0 | — | 0 | 0 | — |
| Southern Plains | 5,873 | 3,341 | 57 | 1,818 | 1,047 | 58 | 3,251 | 1,686 | 52 |
| Mountain | 4,780 | 2,793 | 58 | 804 | 367 | 46 | 3,733 | 2,251 | 60 |
| Pacific | 306 | 89 | 29 | 167 | 10 | 6 | 116 | 61 | 53 |
| U.S. mainland | 24,373 | 14,099 | 58 | 7,812 | 3,746 | 48 | 15,306 | 9,424 | 62 |
| Alaska | 7 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | — |
| Hawaii | 18 | 12 | 67 | 2 | 2 | 100 | 15 | 10 | 67 |
| U.S. total | 24,397 | 14,111 | 58 | 7,821 | 3,748 | 48 | 15,322 | 9,434 | 62 |

*for problem of unfavorable soil*

items listed and data may not check exactly with summary tables]

| soil as the dominant problem and secondary problem of— | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Excess water | | | Adverse climate | | | Cropland having unfavorable soil as the secondary problem | | | Cropland having any problem of unfavorable soil | | |
| Total | Needing treatment | | Total | Needing treatment | | Total | Needing treatment | | Total | Needing treatment | |
| *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *1,000 acres* | *Per-cent* |
| 65 | 39 | 60 | 0 | 0 | — | 2,609 | 1,769 | 68 | 4,275 | 2,729 | 64 |
| 25 | 17 | 68 | 0 | 0 | — | 6,002 | 4,080 | 68 | 14,430 | 10,188 | 71 |
| 382 | 152 | 40 | 0 | 0 | — | 9,999 | 6,546 | 65 | 14,161 | 9,023 | 64 |
| 385 | 224 | 58 | 828 | 571 | 69 | 8,023 | 5,520 | 69 | 16,756 | 11,125 | 66 |
| 134 | 84 | 63 | 0 | 0 | — | 5,295 | 3,655 | 69 | 7,370 | 4,994 | 68 |
| 648 | 539 | 83 | 0 | 0 | — | 2,667 | 1,831 | 69 | 7,562 | 5,391 | 71 |
| 1,414 | 961 | 68 | 0 | 0 | — | 6,169 | 4,194 | 68 | 8,185 | 5,545 | 68 |
| 29 | 24 | 83 | 514 | 381 | 74 | 14,827 | 10,631 | 72 | 20,010 | 14,363 | 72 |
| 918 | 639 | 70 | 592 | 353 | 60 | 4,675 | 3,188 | 68 | 14,513 | 9,486 | 65 |
| 971 | 750 | 77 | 33 | 13 | 39 | 5,588 | 3,892 | 70 | 13,712 | 8,897 | 65 |
| 4,971 | 3,429 | 69 | 1,967 | 1,319 | 67 | 65,854 | 45,305 | 69 | 120,975 | 81,739 | 68 |
| 0 | 0 | — | 10 | 0 | 0 | 0 | 0 | — | 23 | 12 | 52 |
| 0 | 0 | — | 2 | 1 | 50 | 22 | 15 | 68 | 69 | 32 | 46 |
| 4,971 | 3,429 | 69 | 1,978 | 1,320 | 67 | 65,873 | 45,319 | 69 | 121,067 | 81,782 | 68 |

on most of the million acres that also have an excess water problem.

Minimum tillage helps to prevent soil compaction and plow soils that restrict water movement. Soils that have this condition may need chiseling to improve water movement.

Shallow soils are a problem on about 14.7 million acres, of which 8.9 million needs treatment. The Lake States, Corn Belt, Northern Plains, and Pacific regions all have large acreages needing treatment. This condition is of little importance on cropland in the Delta States, Southern Plains, and Mountain regions.

To treat some of these areas it will be necessary to deep-till the land to shatter a hardpan or cemented soil layer. This will aid in enlarging the root zone and water storage capacity. On areas with an erosion problem, cropping systems are needed that will solve both problems. The major control measures will usually center around the use of vegetation for protection rather than terraces or diversions.

In some sections of the country, stoniness is the prevailing unfavorable soil condition. To solve this problem the farmer has to decide between removing the stones, to facilitate tillage and harvesting and leaving them and using the land less intensively.

*for problem of adverse climate*

items listed and data may not check exactly with summary tables]

| climate as the dominant problem and secondary problem of— | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Excess water | | | Unfavorable soil | | | Cropland having adverse climate the secondary problem | | | Cropland having any problem of adverse climate | | |
| Total | Needing treatment | | Total | Needing treatment | | Total | Needing treatment | | Total | Needing treatment | |
| *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *1,000 acres* | *Per-cent* |
| 2 | 2 | 100 | 0 | 0 | — | 0 | 0 | — | 4 | 3 | 75 |
| 0 | 0 | — | 0 | 0 | — | 3,029 | 2,164 | 72 | 3,029 | 2,164 | 71 |
| 0 | 0 | — | 0 | 0 | — | 0 | 0 | — | 0 | 0 | — |
| 100 | 45 | 45 | 82 | 82 | 100 | 9,445 | 6,886 | 73 | 22,855 | 14,759 | 65 |
| 0 | 0 | — | 0 | 0 | — | 0 | 0 | — | 0 | 0 | — |
| 0 | 0 | — | 0 | 0 | — | 0 | 0 | — | 0 | 0 | — |
| 0 | 0 | — | 0 | 0 | — | 0 | 0 | — | 0 | 0 | — |
| 0 | 0 | — | 804 | 608 | 76 | 9,461 | 6,489 | 68 | 15,334 | 9,830 | 64 |
| 70 | 47 | 67 | 173 | 128 | 74 | 17,497 | 10,520 | 60 | 22,277 | 13,313 | 60 |
| 22 | 18 | 82 | 1 | 0 | — | 811 | 643 | 80 | 1,117 | 732 | 66 |
| 194 | 111 | 57 | 1,060 | 818 | 82 | 40,244 | 26,702 | 66 | 64,617 | 40,801 | 63 |
| 0 | 0 | — | 0 | 0 | — | 53 | 32 | 60 | 60 | 32 | 53 |
| 0 | 0 | — | 0 | 0 | — | 16 | 15 | 94 | 34 | 27 | 79 |
| 194 | 111 | 57 | 1,060 | 818 | 82 | 40,313 | 26,749 | 66 | 64,711 | 40,860 | 63 |

TABLE 32.—*Conservation needs on irrigated cropland*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | Total | | Having any problem | | Needing treatment | | Not needing treatment | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | No problem | | Adequately treated | |
| | 1958 | 1975 | | | | | | | | |
| | *1,000 acres* | *1,000 acres* | *1,000 acres* | *Percent* [1] | *1,000 acres* | *Percent* [1] | *1,000 acres* | *Percent* [1] | *1,000 acres* | *Percent* [1] |
| Northern Plains | 3,458 | 5,751 | 4,118 | 72 | 2,912 | 51 | 1,633 | 28 | 1,206 | 21 |
| Southern Plains | 8,770 | 10,780 | 9,383 | 87 | 7,224 | 67 | 1,397 | 13 | 2,159 | 20 |
| Mountain | 13,591 | 15,555 | 13,510 | 87 | 9,431 | 61 | 2,045 | 13 | 4,079 | 26 |
| Pacific | 10,893 | 13,326 | 11,139 | 84 | 7,034 | 53 | 2,187 | 16 | 4,105 | 31 |
| 17 States | 36,712 | 45,412 | 38,150 | 84 | 26,601 | 59 | 7,262 | 16 | 11,549 | 25 |
| Hawaii | 131 | 128 | 116 | 91 | 65 | 51 | 12 | 9 | 51 | 40 |
| 18 States | 36,843 | 45,540 | 38,266 | 84 | 26,666 | 59 | 7,274 | 16 | 11,600 | 25 |

[1] Of the total 1975 irrigated cropland.

Water erosion is often an important secondary problem and, on sloping land with these conditions, such measures as contour tillage and the use of one or more years of grass in the rotation are usually needed. On long, steep slopes it may be possible to use diversions to reduce soil and water losses if the stones do not cause too much difficulty in construction.

**Adverse climate.** Adverse climate may be either from insufficient rainfall or from a short growing season in Northern latitudes or high altitudes. This is a dominant problem on more than 24 million acres of cropland, of which about 14 million can be treated (table 31). This is the only problem on 3.7 million acres, but it is a secondary one on 40.3 million acres having a dominant problem of another kind.

Adverse climate is a hazard that cannot be eliminated except in areas where insufficient rainfall can be supplemented by irrigation (fig. 38). The conservation needs of irrigated cropland are discussed in the following section.

Where a short growing season is the limitation, farmers need to grow crops that are adapted to the growing season, as well as follow a cropping system that will protect the land. The use of stubble-mulching is limited because the soils are usually slow to warm up in the spring with the result that leaving crop residues on the surface may have detrimental effect on seed germination.

Erosion is the most serious secondary problem on cropland with a dominant problem of adverse climate. This combination occurs mainly in the Northern Plains, Southern Plains, and Mountain regions.

Adverse climate is an important secondary problem on 37.3 million acres where erosion is the dominant problem. Cropping systems for these areas should provide both for moisture conservation and for a protective cover to prevent excessive runoff or wind erosion. They should include crops that will make the most efficient use of available moisture.

TABLE 33.—*Irrigated cropland in the*

[Because of rounding, some totals may not equal the sum of the

| Region | Irrigated cropland having erosion as the dominant problem | | | | | | Irrigated cropland having | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | No secondary problem | | | Excess water | | |
| | Total | Needing treatment | | Total | Needing treatment | | Total | Needing treatment | |
| | *1,000 acres* | *1,000 acres* | *Percent* | *1,000 acres* | *1,000 acres* | *Percent* | *1,000 acres* | *1,000 acres* | *Percent* |
| Northern Plains | 2,518 | 1,916 | 76 | 1,255 | 1,013 | 80 | 16 | 11 | 69 |
| Southern Plains | 6,644 | 4,988 | 75 | 2,498 | 1,912 | 76 | 8 | 7 | 88 |
| Mountain | 5,470 | 3,815 | 70 | 2,683 | 1,792 | 67 | 80 | 67 | 84 |
| Pacific | 2,927 | 2,007 | 68 | 1,460 | 950 | 65 | 81 | 43 | 53 |
| 17 States | 17,559 | 12,726 | 72 | 7,896 | 5,667 | 72 | 185 | 128 | 69 |
| Hawaii | 87 | 47 | 54 | 75 | 40 | 53 | 1 | 1 | 100 |
| 18 States | 17,646 | 12,773 | 72 | 7,971 | 5,707 | 72 | 186 | 129 | 69 |

[1] Of the total 1975 irrigated cropland.

## CONSERVATION TREATMENT FOR IRRIGATED CROPLAND

The CNI obtained separate data on conservation treatment needs on irrigated cropland in the 17 Western States and Hawaii. In 1958 about 36.8 million acres of cropland were irrigated in those States (table 32). This is expected to increase to 45.5 million acres by 1975.

Of this amount, about 38.3 million acres or 84 percent has a conservation problem, and 26.7 million acres or 59 percent needs treatment.

Erosion is the most widespread problem on irrigated cropland as it is on all cropland. It is the dominant problem on 17.6 million acres of irrigated land in the West (table 33).

To reduce erosion damages on irrigated land it is necessary to adjust rates of water applications to avoid excessive runoff or, in some cases, to apply water in contour furrows rather than in furrows down the slope. The length of run needs to be based on the permeability of the soil in each field to reduce soil and water losses.

Excess water is a dominant problem on about 5.5 million acres of western irrigated land (table 34).

On soils that have an excess water problem, internal or surface water must be removed with a water-disposal system. This is especially important on soils that have excess concentrations of salt. About 3.3 million acres has an excess water problem with unfavorable soils as a secondary problem, and 1.6 million acres has unfavorable soils with excess water as a secondary problem.

On irrigated land the water table must be kept below the root zone, preferably at a depth of more than 5 feet. In some areas drainage pump wells are used to lower the water table. In many areas water from drains is reused for irrigation; but in others the drainage water is high in salts and must be wasted. Disposal of salty water no doubt will increase in importance as additional land is brought under irrigation.

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***Figure 38.*—Irrigation compensates for insufficient rainfall to offset the limitation of adverse climate in arid areas. Where short growing season is the problem, a quick-growing crop such as potatoes can be used.**

In the Mountain and Pacific regions, unfavorable soil is the dominant problem on more acres of irrigated cropland than all other hazards combined. In addition, unfavorable soil is the most widespread secondary problem throughout the West (table 35). Sprinkler systems are used in many areas to irrigate shallow or sandy soils. Most of saline or alkaline soils require continuous treatment to lessen crop damages from salt concentrations.

Adverse climate is a problem on nearly 1.9 million acres of irrigated cropland (table 36), of which 1.1 million acres needs treatment. Most of this cropland is in the Northern Plains

*West having problem of erosion*

items listed and data may not check exactly with summary tables]

erosion as the dominant problem and secondary problem of—

| Unfavorable soil | | | Adverse climate | | | Irrigated cropland having erosion as the secondary problem | | | Irrigated cropland having any problem of erosion | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Total | Needing treatment | | Total | Needing treatment | | Total | Needing treatment | | Total | Needing treatment | |
| *1,000 acres* | *1,000 acres* | *Percent* | *1,000 acres* | *1,000 acres* | *Percent* | *1,000 acres* | *1,000 acres* | *Percent* | *1,000 acres* | *1,000 acres* | *Percent* |
| 615 | 404 | 66 | 632 | 489 | 77 | 542 | 289 | 53 | 3,060 | 2,205 | 72 |
| 4,056 | 3,019 | 75 | 82 | 50 | 61 | 178 | 121 | 68 | 6,822 | 5,109 | 75 |
| 1,898 | 1,429 | 75 | 809 | 527 | 65 | 2,836 | 2,081 | 74 | 8,306 | 5,896 | 71 |
| 1,372 | 1,000 | 73 | 14 | 14 | 100 | 1,082 | 749 | 69 | 4,009 | 2,756 | 69 |
| 7,941 | 5,852 | 74 | 1,537 | 1,080 | 70 | 4,638 | 3,240 | 70 | 22,197 | 15,966 | 72 |
| 11 | 6 | 54 | 0 | 0 | — | 7 | 3 | 43 | 94 | 50 | 53 |
| 7,952 | 5,858 | 74 | 1,537 | 1,080 | 70 | 4,645 | 3,243 | 70 | 22,293 | 16,016 | 72 |

TABLE 34.—*Irrigated cropland in the*

[Because of rounding, some totals may not equal the sum of the

| Region | Irrigated cropland having excess water as the dominant problem | | | | | | Irrigated cropland having | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | No secondary problem | | | Erosion hazard | | |
| | Total | Needing treatment | | Total | Needing treatment | | Total | Needing treatment | |
| | *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *1,000 acres* | *Per-cent* |
| Northern Plains | 438 | 266 | 61 | 283 | 167 | 59 | 37 | 21 | 57 |
| Southern Plains | 1,649 | 1,404 | 85 | 373 | 291 | 78 | 0 | 0 | — |
| Mountain | 1,231 | 873 | 71 | 434 | 337 | 78 | 139 | 102 | 73 |
| Pacific | 2,223 | 1,342 | 60 | 576 | 338 | 59 | 269 | 188 | 70 |
| 17 States | 5,541 | 3,885 | 70 | 1,666 | 1,133 | 68 | 445 | 311 | 70 |
| Hawaii | 5 | 3 | 60 | 2 | 1 | 50 | 0 | 0 | — |
| 18 States | 5,546 | 3,888 | 70 | 1,668 | 1,134 | 68 | 445 | 311 | 70 |

TABLE 35.—*Irrigated cropland in the West*

[Because of rounding, some totals may not equal the sum of the

| Region | Irrigated cropland having unfavorable soil as the dominant problem | | | | | | Irrigated cropland having | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | No secondary problem | | | Erosion hazard | | |
| | Total | Needing treatment | | Total | Needing treatment | | Total | Needing treatment | |
| | *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *1,000 acres* | *Per-cent* |
| Northern Plains | 414 | 243 | 59 | 343 | 191 | 56 | 19 | 13 | 68 |
| Southern Plains | 937 | 736 | 79 | 875 | 692 | 79 | 60 | 43 | 72 |
| Mountain | 5,929 | 4,221 | 71 | 2,316 | 1,618 | 70 | 2,369 | 1,761 | 74 |
| Pacific | 5,877 | 3,663 | 62 | 4,399 | 2,553 | 58 | 803 | 553 | 69 |
| 17 States | 13,157 | 8,863 | 67 | 7,933 | 5,054 | 64 | 3,251 | 2,370 | 73 |
| Hawaii | 20 | 6 | 30 | 15 | 4 | 27 | 5 | 2 | 40 |
| 18 States | 13,177 | 8,869 | 67 | 7,948 | 5,058 | 64 | 3,256 | 2,372 | 73 |

TABLE 36.—*Irrigated cropland in the West*

[Because of rounding, some totals may not equal the sum of the

| Region | Irrigated cropland having adverse climate as the dominant problem | | | | | | Irrigated cropland having adverse | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | No secondary problem | | | Erosion hazard | | |
| | Total | Needing treatment | | Total | Needing treatment | | Total | Needing treatment | |
| | *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *1,000 acres* | *Per-cent* |
| Northern Plains | 748 | 488 | 65 | 262 | 233 | 89 | 486 | 255 | 52 |
| Southern Plains | 153 | 96 | 63 | 35 | 18 | 51 | 118 | 78 | 66 |
| Mountain | 880 | 524 | 59 | 453 | 243 | 54 | 328 | 218 | 66 |
| Pacific | 112 | 23 | 20 | 92 | 6 | 7 | 10 | 8 | 80 |
| 17 States | 1,893 | 1,131 | 60 | 842 | 500 | 59 | 942 | 559 | 59 |
| Hawaii | 4 | 1 | 25 | 1 | (1) | 0 | 2 | 1 | 50 |
| 18 States | 1,897 | 1,132 | 60 | 843 | 500 | 59 | 944 | 560 | 59 |

[1] Less than 1 percent.

## *West having problem of excess water*

items listed and data may not check exactly with summary tables]

| excess water as the dominant problem and secondary problem of— | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unfavorable soil | | | Adverse climate | | | Irrigated cropland having excess water as the secondary problem | | | Irrigated cropland having any problem of excess water | | |
| Total | Needing treatment | | Total | Needing treatment | | Total | Needing treatment | | Total | Needing treatment | |
| *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *1,000 acres* | *Per-cent* |
| 118 | 78 | 66 | 0 | 0 | — | 64 | 48 | 75 | 502 | 314 | 63 |
| 1,276 | 1,113 | 87 | 0 | 0 | — | 10 | 8 | 80 | 1,659 | 1,412 | 85 |
| 580 | 388 | 67 | 78 | 46 | 59 | 992 | 697 | 70 | 2,223 | 1,570 | 71 |
| 1,309 | 778 | 59 | 69 | 38 | 55 | 748 | 607 | 81 | 2,971 | 1,949 | 66 |
| 3,283 | 2,357 | 72 | 147 | 84 | 57 | 1,814 | 1,360 | 75 | 7,355 | 5,245 | 71 |
| 3 | 2 | 67 | 0 | 0 | — | 1 | 1 | 100 | 6 | 4 | 67 |
| 3,286 | 2,359 | 72 | 147 | 84 | 57 | 1,815 | 1,361 | 75 | 7,361 | 5,249 | 71 |

## *having problem of unfavorable soil*

items listed and data may not check exactly with summary tables]

| unfavorable soil as the dominant problem and secondary problem of— | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Excess water | | | Adverse climate | | | Irrigated cropland having unfavorable soil as the secondary problem | | | Irrigated cropland having any problem of unfavorable soil | | |
| Total | Needing treatment | | Total | Needing treatment | | Total | Needing treatment | | Total | Needing treatment | |
| *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *1,000 acres* | *Per-cent* |
| 48 | 37 | 77 | 4 | 2 | 50 | 733 | 482 | 66 | 1,147 | 725 | 63 |
| 2 | 1 | 50 | 0 | 0 | — | 5,332 | 4,132 | 78 | 6,269 | 4,868 | 78 |
| 882 | 618 | 70 | 362 | 224 | 62 | 2,547 | 1,868 | 73 | 8,476 | 6,089 | 72 |
| 657 | 555 | 84 | 18 | 2 | 11 | 2,681 | 1,778 | 66 | 8,558 | 5,441 | 64 |
| 1,589 | 1,211 | 76 | 384 | 228 | 59 | 11,293 | 8,260 | 73 | 24,450 | 17,123 | 70 |
| 0 | 0 | — | 0 | 0 | — | 15 | 8 | 53 | 35 | 14 | 40 |
| 1,589 | 1,211 | 76 | 384 | 228 | 59 | 11,308 | 8,268 | 73 | 24,485 | 17,137 | 70 |

## *having problem of adverse climate*

items listed and data may not check exactly with summary tables]

| climate as the dominant problem and secondary problem of— | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Excess water | | | Unfavorable soil | | | Irrigated cropland having adverse climate as the secondary problem | | | Irrigated cropland having any problem of adverse climate | | |
| Total | Needing treatment | | Total | Needing treatment | | Total | Needing treatment | | Total | Needing treatment | |
| *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *1,000 acres* | *Per-cent* |
| 0 | 0 | — | 0 | 0 | — | 636 | 491 | 77 | 1,384 | 979 | 71 |
| 0 | 0 | — | 0 | 0 | — | 82 | 50 | 61 | 235 | 146 | 62 |
| 30 | 12 | 40 | 69 | 51 | 74 | 1,249 | 797 | 64 | 2,129 | 1,321 | 62 |
| 10 | 9 | 90 | 0 | 0 | — | 101 | 54 | 53 | 213 | 77 | 36 |
| 40 | 21 | 52 | 69 | 51 | 74 | 2,068 | 1,392 | 67 | 3,961 | 2,523 | 64 |
| 0 | 0 | — | 1 | 0 | 0 | 0 | 0 | — | 4 | 1 | 25 |
| 40 | 21 | 52 | 70 | 51 | 73 | 2,068 | 1,392 | 67 | 3,965 | 2,524 | 64 |

and Mountain regions. About half of it has a secondary problem of erosion. Adverse climate is a secondary problem on 1.6 million acres, half of which has erosion as the dominant problem. About 1.4 million acres with climate as the secondary problem needs treatment.

In high altitudes and in northern areas, the short growing season limits the kind of crops that can be grown. In these areas it is necessary to grow early-maturing crops or grasses and legumes for hay and pasture. In regions having low precipitation, more efficient use of available water and the use of crops that make their growth when the water is available will help reduce the limiting effect of climate.

### *Pasture and Range*

The prospective need for pasture and rangeland in the decades ahead is in sharp contrast to that for cultivated cropland. More, not less, grazing land will be needed to keep up with the increasing demand for animal products.

If the population increases by 45 percent by 1980, as expected, the need for livestock production will increase 50 to 55 percent over the 1959 level (USDA–LWP, 1962, p. 36) and the demand for meat from grazing animals probably will increase 70 to 80 percent.[6] The grazing capacity of existing range and pasture cannot be expected to increase rapidly enough to accommodate such an increase in livestock. Some of the additional production will depend on new land added to the grazing resource. It is also important that full conservation treatment be applied as rapidly as possible to bring land now in range and pasture to a high level of productivity.

Existing pasture and rangeland is ill-prepared to supply the rapidly expanding needs for meat. A recent USDA study showed that grazing lands are producing forage at no more than half their potential.

For the past half century or more, continued overuse has seriously depleted forage resources. Brush, weeds, and other unwanted vegetation have encroached upon millions of acres that once were good grazing land; tons of topsoil are being eroded from them to pollute streams, fill reservoirs, and damage domestic, agricultural, and industrial water supplies. A long and costly effort will be necessary to halt the deterioration, even if the task is begun immediately; the longer it is delayed, the greater will be the ultimate cost of restoring grazing land to the level necessary to meet forage needs in the years ahead.

Forage and range problems are particularly critical in the 11 Western States where water shortage is also a chronic problem. Conservative estimates indicate that half the sediment being carried into major streams of the Southwest comes from land where grazing has upset the delicate balance between plant cover and the soil mantle.[7] Steeply sloping land with scant plant cover and excessive erosion is being grazed in conjunction with better land with which it is interspersed.

The objectives of pasture and rangeland conservation are (1) to stop deterioration of grazing resources; (2) to rehabilitate and repair those resources that have been damaged by overuse and neglect; (3) to create public understanding that will give appropriate consideration to forage resource problems; and (4) to coordinate the forage resource programs with other conservation programs on public and private land.

Forage resource problems play no favorites with the different land ownerships, geographic areas, or managing agencies. Neither the Federal Government nor private interests alone can be expected to assume the responsibility for correcting these problems.

Since over two-thirds of the grazing land is in private ownership, voluntary action by producers must be depended on for most of the improvements to be made on pasture and range. Thousands of private land operators have already made substantial improvements in grazing land. Greatest achievements have occurred where there has been a combination of (1) active local leadership such as through soil conservation districts and grazing associations, (2) inspired and sound technical assistance, (3) rational cost sharing, and (4) informed and inspired producers.

All problems and treatments considered in the Conservation Needs Inventory (CNI), except management of excess water, require attention every year to attain conservation on pasture and rangeland. In this respect, the conservation job is never complete.

Farmers and ranchers must realize the importance of the management and cultural practices needed to keep their grassland productive and to furnish quality forage throughout the grazing season.

Basically, these measures center around growing forage species that are adapted to the soil and climate; supplying needed amounts of fertilizers and soil amendments, especially on tame pastures; using grazing management that favors desired plants; and controlling weeds, brush, and other undesirable plants.

Grassland is the most neglected part of many farms and ranches, yet on many it can be made to produce more net income per acre than many other crops.

[6] Unpublished data, U.S. Department of Agriculture and U.S. Department of Interior, compiled as background information for President's Message on Natural Resources, January, 1962.

[7] Ibid.

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*Figure 39.*—**Bluegrass and other grasses planted on land that was originally forested make up most of the pasture in the humid East.**

## LAND USED FOR PASTURE AND RANGE

About one-third of the Nation's non-Federal rural land or about 485 million acres is used as pasture and range as defined by the CNI. This acreage is larger than that in any other agricultural use included in the Inventory.

As defined in the Inventory, pasture and range is "land in grass or other long-term forage growth used primarily for grazing." Pasture is composed primarily of introduced grasses (fig. 39) and range of native grasses. Pasture and range does not include grazing land in a crop rotation or any land having more than 10 percent canopy of trees and shrubs whether grazed or not. Some 40 million acres of brushy range (pinyon-juniper, chaparral, etc.) in the West are not considered as rangeland in this Inventory but are included in the acreage of forest and woodland.

This definition of pasture and range is essentially the same as "grassland pasture and range" of the Census of Agriculture. "Total land pastured" of the census includes, in addition, "woodland pastured" and "cropland pastured" on both private and public land.

The CNI deals only with the 485.4 million acres of non-Federal pasture and range. In addition to the private and non-Federal grazing land, 242.5 million acres of Federal range in the 50 States including Alaska and Hawaii (240.4 million in the 48 mainland States) plus another 161.3 (160.3) million acres of non-Federal forest and woodland are used for grazing (Wooten, 1962). This 242.5 (240.4) million acres includes 83 million acres of forest and woodland used for grazing. Altogether, about 889.1 (885.4) million acres in the United States is used for grazing (table 37).

Domestic livestock also graze about 66 million acres of cropland used only for pasture and consume hay from 63 million acres (Wooten 1962). Forage from range and pasture supplies 32 percent of the feed units for dairy cattle, 61 percent for beef cattle, and 86 percent for sheep and goats.[8] About 10 million big game animals obtain most of their forage from range and pasture.

## EXPECTED CHANGES IN PASTURE AND RANGE

Estimates by local CNI committees of probable land use changes by 1975 indicate that pasture and range may be expected to increase from 485.4 (484.7) million acres to 498.0 (497.2) million acres—a net increase of 13 million acres or 2.6 percent (table 38).

This net increase will result from the conversion of 44.8 (44.6) million acres from other uses to pasture and range and the conversion of 32.2 million acres from pasture and range to other uses.

The land brought into pasture and range will present many special conservation problems. It will require land preparation, varying with its former use, then the establishment of desirable grass cover and needed conservation practices to keep it in productive condition in its new use. About 24.6 million acres or 55 percent will be converted from cropland and 14.3 (14.2)

[8] Ibid.

TABLE 37.—*Pasture and range in the United States*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | Private and non-Federal public | | | Federal range [2] 1959 | Total grazing land |
|---|---|---|---|---|---|
| | Pasture and range, 1958 [1] | Woodland [2], pasture and range, 1959 | Total | | |
| | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* |
| Northeast | 7,990 | 3,464 | 11,454 | 24 | 11,478 |
| Lake States | 8,811 | 6,011 | 14,822 | 20 | 14,842 |
| Corn Belt | 21,934 | 12,629 | 34,563 | 292 | 34,855 |
| Northern Plains | 83,902 | 2,544 | 86,446 | 3,484 | 89,929 |
| Appalachian | [3] 15,657 | 8,408 | 24,065 | 109 | 24,174 |
| Southeast | 13,930 | 18,673 | 32,603 | 1,076 | 33,679 |
| Delta States | [4] 9,331 | 26,723 | 36,054 | 1,952 | 38,006 |
| Southern Plains | [5] 109.447 | 29,713 | 139,160 | 1,189 | 140,349 |
| Mountain | 182,583 | 34,300 | 216,883 | 192,536 | 409,419 |
| Pacific | 31,130 | 17,830 | 48,960 | 39,718 | 88,678 |
| U.S. mainland | 484,716 | 160,295 | 645,011 | 240,400 | 885,411 |
| Alaska | 2 | 520 | 522 | 2,120 | 2,642 |
| Hawaii | 646 | 441 | 1,087 | 0 | 1,087 |
| U.S. total | 485,364 | 161,256 | 646,620 | 242,520 | 889,140 |

[1] USDA–CNI, 1962, table 4.
[2] Wooten, 1962, table 17.
[3] Includes 1,722,000 acres in Kentucky and 992,000 acres in Tennessee generally used for pasture but infrequently broken out for cultivated crops or small grain.
[4] Excludes considerable idle land in Arkansas used to some extent for grazing; some is cropped occasionally.
[5] Excludes 4,361,000 acres in Texas that was idle 3 or more years, of which a part is used to some extent for grazing.

million or 32 percent from woodland (table 39). The latter will have to be cleared of trees and brush before the land can be seeded to grass.

Land coming into pasture and range is expected to be about equally divided between land suitable for regular cultivation (classes I–III) and land unsuited (classes V–VIII) or marginal (class IV) (table 40). Most of it has conservation problems that limit its capability for use (table 41). The potential grass productivity of new pasture and range is usually lower than that of land being converted from grassland to cropland or other uses.

Planting and maintaining these difficult areas in grass will require technical skills considerably greater than those needed for similar work on better soils. A great variety of locally adapted seeds will be required in small amounts, thus creating a complicated problem of providing suitable plant materials. Plants

TABLE 38.—*Expected changes in pasture and range, 1958 to 1975*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | Pasture and range, 1958 | Going out of pasture and range | Coming into pasture and range | Net change | |
|---|---|---|---|---|---|
| | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *Percent* |
| Northeast | 7,990 | 2,204 | 1,414 | — 790 | −10 |
| Lake States | 8,811 | 2,436 | 1,158 | — 1,278 | −14 |
| Corn Belt | 21,934 | 5,612 | 4,079 | — 1,533 | — 7 |
| Northern Plains | 83,902 | 3,695 | 5,218 | + 1,523 | + 2 |
| Appalachian | 15,657 | 2,779 | 4,144 | + 1,367 | + 9 |
| Southeast | 13,930 | 2,636 | 4,263 | + 1,527 | +11 |
| Delta States | 9,330 | 1,042 | 4,417 | + 3,375 | +36 |
| Southern Plains | 109,447 | 4,793 | 11,360 | + 6,567 | + 6 |
| Mountain | 182,583 | 4,362 | 6,579 | + 2,217 | + 1 |
| Pacific | 31,130 | 2,636 | 2,002 | — 634 | — 2 |
| U.S. mainland | 484,716 | 32,195 | 44,634 | +12,439 | + 3 |
| Alaska | 2 | 0 | 28 | + 28 | — |
| Hawaii | 646 | 12 | 108 | + 96 | +15 |
| U.S. total | 485,364 | 32,207 | 44,769 | 12,563 | + 3 |

TABLE 39.—*Former land use of land expected to be in non-Federal pasture and range by 1975*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | Remaining in pasture and range | Coming into pasture and range | | | | Total new pasture and range | Total pasture and range, 1975 |
|---|---|---|---|---|---|---|---|
| | | Crop-land | Forest and woodland | Other land | Public land [1] | | |
| | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* |
| Northeast | 5,787 | 1,042 | 207 | 165 | 0 | 1,414 | 7,201 |
| Lake States | 6,375 | 553 | 483 | 121 | 0 | 1,157 | 7,533 |
| Corn Belt | 16,322 | 2,705 | 1,083 | 291 | 0 | 4,079 | 20,401 |
| Northern Plains | 80,207 | 4,917 | 231 | 67 | 4 | 5,219 | 85,424 |
| Appalachian | 12,878 | 2,382 | 1,275 | 487 | 0 | 4,144 | 17,022 |
| Southeast | 11,294 | 1,820 | 1,693 | 750 | 0 | 4,263 | 15,557 |
| Delta States | 8,287 | 2,385 | 1,779 | 253 | 0 | 4,417 | 12,704 |
| Southern Plains | 104,654 | 5,752 | 4,895 | 709 | 4 | 11,360 | 116,015 |
| Mountain | 178,221 | 2,690 | 1,465 | 360 | 2,064 | 6,579 | 184,799 |
| Pacific | 28,494 | 381 | 1,029 | 6 | 585 | 2,001 | 30,496 |
| U.S. mainland | 452,521 | 24,626 | 14,140 | 3,209 | 2,657 | 44,632 | 497,153 |
| Alaska | 2 | 0 | 23 | 4 | 0 | 27 | 29 |
| Hawaii | 634 | 7 | 0 | 101 | 0 | 108 | 742 |
| U.S. total | 453,157 | 24,633 | 14,264 | 3,214 | 2,657 | 44,768 | 497,924 |

[1] Mostly pasture and range coming into private ownership through projects developed by the Department of the Interior.

growing on these new pasture and range areas will need skillful management to keep grass stands thrifty.

## CONSERVATION TREATMENT NEEDED

The CNI indicates that nearly three-fourths of the non-Federal pasture and range, including that expected to come into this use by 1975, needs conservation treatment. Of the 498.0 (497.2) million acres, about 364.8 (364.2) million acres needs treatment and is feasible to treat (fig. 40, table 42).

About 133.2 (133.0) million acres of private and locally owned pasture and range is reported as not needing treatment. However, this land as well as that receiving new conservation treatment will need to be grazed properly to maintain plant cover, undesirable plants will need to be kept under control, and water conservation structures kept in good repair.

Grazing management must provide for the needs of plants in each stage of growth. Timely periods of rest during the growing season are usually needed to allow plants to produce seed and reproduce by rootstalks and stolons. It is usually impracticable to keep livestock out of all pastures while the grass grows, but some system of rotation and deferment can usually be devised to allow some pastures to be rested while others are grazed. Over a period of years, all pastures can benefit from growing-season

TABLE 40.—*Land capability of land expected to come into non-Federal pasture and range by 1975*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | Class I–III | | Class IV | | Class V–VIII | | Total | |
|---|---|---|---|---|---|---|---|---|
| | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* |
| Northeast | 839 | 60 | 324 | 23 | 251 | 17 | 1,414 | 100 |
| Lake States | 626 | 54 | 253 | 22 | 278 | 24 | 1,158 | 100 |
| Corn Belt | 1,560 | 38 | 1,025 | 25 | 1,494 | 37 | 4,079 | 100 |
| Northern Plains | 1,457 | 28 | 1,233 | 24 | 2,527 | 48 | 5,218 | 100 |
| Appalachian | 2,105 | 51 | 919 | 22 | 1,115 | 27 | 4,139 | 100 |
| Southeast | 3,065 | 72 | 779 | 18 | 419 | 10 | 4,263 | 100 |
| Delta States | 3,242 | 74 | 538 | 12 | 623 | 14 | 4,403 | 100 |
| Southern Plains | 5,156 | 45 | 2,113 | 19 | 4,092 | 36 | 11,360 | 100 |
| Mountain | 730 | 11 | 1,021 | 16 | 4,827 | 73 | 6,579 | 100 |
| Pacific | 245 | 12 | 388 | 20 | 1,370 | 68 | 2,002 | 100 |
| U.S. mainland | 19,025 | 43 | 8,593 | 19 | 16,996 | 38 | 44,614 | 100 |
| Alaska | 11 | 39 | 9 | 32 | 8 | 29 | 28 | 100 |
| Hawaii | 5 | 5 | 16 | 15 | 87 | 80 | 108 | 100 |
| U.S. total | 19,031 | 43 | 8,618 | 19 | 17,091 | 38 | 44,750 | 100 |

TABLE 41.—*Dominant conservation problems on land expected to come into pasture and range by 1975*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | No problem class I | | Erosion hazard (subclass e) | | Excess water (subclass w) | | Unfavorable soil (subclass s) | | Adverse climate (subclass c) | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* |
| Northeast | 23 | 2 | 853 | 60 | 348 | 25 | 190 | 13 | 0 | — | 1,414 | 100 |
| Lake States | 6 | 1 | 507 | 43 | 357 | 31 | 288 | 25 | 0 | — | 1,158 | 100 |
| Corn Belt | 61 | 1 | 3,249 | 80 | 430 | 11 | 339 | 8 | 0 | — | 4,079 | 100 |
| Northern Plains | 21 | (1) | 4,102 | 79 | 297 | 6 | 697 | 13 | 101 | 2 | 5,218 | 100 |
| Appalachian | 58 | 1 | 3,064 | 75 | 678 | 16 | 339 | 8 | 0 | — | 4,139 | 100 |
| Southeast | 121 | 3 | 1,921 | 45 | 1,215 | 28 | 1,006 | 24 | 0 | — | 4,263 | 100 |
| Delta States | 175 | 4 | 1,995 | 45 | 1,752 | 40 | 481 | 28 | 0 | — | 4,403 | 100 |
| Southern Plains | 261 | 2 | 8,237 | 73 | 1,317 | 12 | 1,376 | 15 | 169 | 1 | 11,360 | 100 |
| Mountain | 6 | (1) | 3,288 | 50 | 113 | 2 | 1,581 | 7 | 1,589 | 24 | 6,579 | 100 |
| Pacific | 6 | (1) | 1,250 | 62 | 74 | 4 | 557 | 64 | 115 | 6 | 2,002 | 100 |
| U.S. mainland | 737 | 2 | 28,466 | 64 | 6,582 | 15 | 6,856 | | 1,973 | 4 | 44,614 | 100 |
| Alaska | 0 | | 8 | 29 | 16 | 57 | 2 | | 2 | 7 | 28 | 100 |
| Hawaii | 0 | | 25 | 23 | 2 | 2 | 68 | | 12 | 11 | 107 | 100 |
| U.S. total | 737 | | 28,498 | | 6,601 | | 6,926 | | 1,987 | | 44,749 | 100 |

[1] Less than 0.5 of 1 percent.

rests. The pastures being grazed must not be overused while the others are rested, however, or the benefits of deferment are lost.

**Establishment of plant cover**

Of the non-Federal pasture and range considered in this study, about 72.4 (72.0) million acres or 14 percent (table 42) needs to be seeded to establish desirable plant cover (fig. 41). About half of this or 36 million acres would be tame pasture (fig. 42). An additional 21 million acres of public rangeland also needs to be planted to productive forage plants.[9]

Nearly 24 million acres or about one-third of the total acreage needing establishment of cover is in the Southern Plains region, and 11 million acres or about a sixth is in the Mountain region.

Grass for livestock and game is the only crop that can be grown safely and continuously on

[9] Ibid.

TABLE 42.—*Non-Federal pasture and*

[Because of rounding, some totals may not equal the sum of the

| Region | Total pasture-range 1975 | Not needing treatment | | Needing treatment for— | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Total [1] | | Establishment of cover | | Improvement of cover | | Protection only [2] | |
| | *1,000 acres* | *1,000 acres* | *Percent* [3] | *1,000 acres* | *Percent* [3] | *1,000 acres* | *Percent* [3] | *1,000 acres* | *Percent* [3] | *1,000 acres* | *Percent* [3] |
| Northeast | 7,201 | 2,504 | 35 | 4,697 | 65 | 2,211 | 31 | 2,049 | 28 | 437 | 6 |
| Lake States | 7,533 | 2,097 | 28 | 5,436 | 72 | 2,688 | 36 | 2,315 | 31 | 433 | 6 |
| Corn Belt | 20,401 | 6,396 | 31 | 14,005 | 69 | 6,028 | 30 | 5,928 | 29 | 2,049 | 10 |
| Northern Plains | 85,425 | 35,739 | 42 | 49,686 | 58 | 7,230 | 8 | 10,630 | 12 | 31,826 | 37 |
| Appalachian | 17,022 | 5,211 | 31 | 11,811 | 69 | 5,512 | 32 | 5,219 | 31 | 1,080 | 6 |
| Southeast | 15,557 | 3,945 | 25 | 11,612 | 75 | 5,278 | 34 | 4,490 | 29 | 1,844 | 12 |
| Delta States | 12,705 | 3,360 | 26 | 9,345 | 74 | 4,578 | 36 | 3,624 | 29 | 1,143 | 9 |
| Southern Plains | 116,015 | 17,470 | 15 | 98,545 | 85 | 23,650 | 20 | 22,433 | 19 | 52,462 | 45 |
| Mountain | 184,799 | 47,912 | 26 | 136,887 | 74 | 11,168 | 6 | 44,075 | 24 | 81,644 | 44 |
| Pacific | 30,496 | 8,357 | 27 | 22,139 | 73 | 3,662 | 12 | 6,604 | 22 | 11,873 | 39 |
| U.S. mainland | 497,154 | 132,991 | 27 | 364,163 | 73 | 72,005 | 14 | 107,367 | 22 | 184,791 | 38 |
| Alaska | 62 | 35 | 56 | 27 | 44 | 5 | 8 | 22 | 35 | 0 | — |
| Hawaii | 742 | 135 | 18 | 607 | 82 | 370 | 50 | 181 | 24 | 56 | 8 |
| U.S. total | 497,958 | 133,161 | 27 | 364,797 | 73 | 72,380 | 14 | 107,570 | 22 | 184,847 | 38 |

[1] Total pasture and range, 1975, less acreage not needing treatment.

[2] Total needing treatment less acreage needing establishment or improvement of cover.

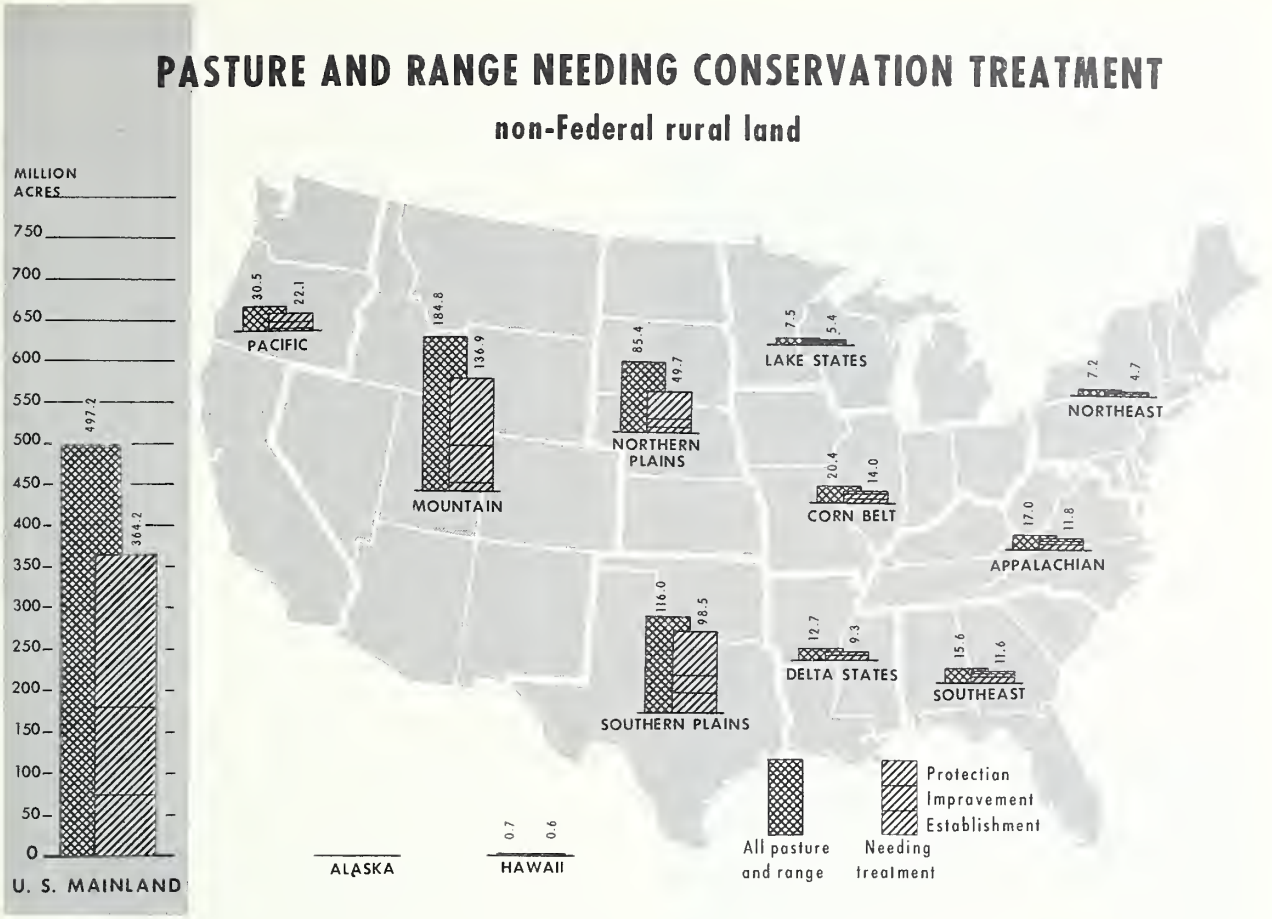


*Figure 40.*

*range needing conservation treatment by 1975*

items listed and data may not check exactly with summary tables]

| Needing protection from— | | | | | | | | | | Needing water management for— | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Overgrazing [4] | | Fire [4] | | Erosion [4] | | Rodents [4] | | Woody and noxious plants [4] | | Excess water | | Water conservation | |
| *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* [3] | *1,000 acres* | *Percent* [3] |
| 222 | 3 | 5 | (5) | 159 | 2 | 5 | (5) | 250 | 3 | 987 | 14 | 180 | 2 |
| 209 | 3 | 36 | (5) | 160 | 2 | 61 | 1 | 109 | 2 | 767 | 11 | 95 | 1 |
| 1,685 | 8 | 238 | 1 | 1,119 | 5 | 24 | (5) | 1,148 | 6 | 351 | 2 | 39 | (5) |
| 30,742 | 36 | 9,117 | 11 | 2,099 | 2 | 269 | (5) | 2,062 | 2 | 413 | (5) | 3,114 | 4 |
| 1,079 | 6 | 163 | 1 | 150 | 1 | 7 | (5) | 600 | 4 | 881 | 5 | 70 | (5) |
| 1,358 | 9 | 2,780 | 18 | 306 | 2 | 43 | (5) | 445 | 3 | 2,975 | 19 | 1,495 | 10 |
| 953 | 8 | 1,172 | 9 | 712 | 6 | 648 | 5 | 1,121 | 9 | 2,199 | 17 | 439 | 3 |
| 49,634 | 43 | 19,174 | 17 | 4,114 | 4 | 1,551 | 1 | 28,692 | 25 | 1,477 | 1 | 4,620 | 4 |
| 67,782 | 37 | 30,338 | 16 | 21,022 | 11 | 5,661 | 3 | 20,339 | 11 | 741 | (5) | 12,448 | 7 |
| 9,416 | 31 | 10,037 | 32 | 2,100 | 7 | 2,958 | 10 | 2,290 | 8 | 419 | 1 | 724 | 2 |
| 163,080 | 33 | 73,060 | 15 | 31,989 | 7 | 11,226 | 2 | 57,056 | 11 | 11,213 | 2 | 23,223 | 5 |
| 0 | — | 0 | — | 0 | — | 0 | — | 0 | — | 4 | 6 | 0 | — |
| 89 | 12 | 13 | 2 | 76 | 10 | 0 | — | 55 | 7 | 1 | (5) | 5 | 1 |
| 163,169 | 33 | 73,072 | 15 | 32,065 | 7 | 11,226 | 2 | 57,111 | 11 | 11,219 | 2 | 23,228 | 5 |

[3] Of total pasture and range, 1975.

[4] Acreages in addition to those needing establishment or improvement of cover; the same acreage may need two or more types of protection.

[5] Less than 0.5 of 1 percent.

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*Figure 41.*—**Part of the 72 million acres of pasture and range needing establishment of new cover is former cropland that can be seeded directly to range grasses.**

TEX-49766

*Figure 42.*—**A heavy disk is used to prepare land and cover bermudagrass sprigs to establish new pasture in a humid area.**

much of this land. Even on that suitable for cultivation, there are many areas where the net return from grass will equal that from cultivated crops under normal conditions. When prices for livestock, hay, and seed are high, the net return from grass frequently exceeds that from wheat, sorghum, or cotton.

The grasses that are best for grazing and livestock production are also best for soil and water conservation. To grow new grass on land now bare and to improve and maintain existing grassland are of primary importance in soil and water conservation.

About 45 million acres of former cropland, woodland, and other land will be converted to pasture and range by 1975. Most of this land is eroded, wet, steep, sandy, infertile, saline, alkaline, or arid. Special treatment and management will be required to seed these areas and keep adequate cover on them after it is established.

Land where erosion is the dominant hazard makes up more than half of the new pasture and range and constitutes the largest acreage in all ten regions. About a sixth of the new pasture and range will be land where soil conditions are the dominant limitation, mainly in the Northern and Southern Plains, Mountain, and Southeast regions. Almost an equal acreage will be wet land, mainly in the Delta States, Southeast, and Appalachian regions.

More than 2.5 million acres of range and pasture, mainly from Federal land, is expected to come into private ownership by 1975. In reclamation projects in the Mountain and Pacific regions, much of this land is in capability classes V to VIII, land costly and difficult to plant and manage.

Revegetation and successful management of much of the land will require extraordinary skill in the selection of correct species to be planted, in seedbed preparation, and in grazing supervision.

Best results in establishing new grass stands have been obtained in the higher rainfall areas. Elsewhere successful seedings have been made on overflow land and on subirrigated, gravelly, rocky, and sandy areas. In the low rainfall areas results have been poorest where soils are heavy or alkaline and where wind erosion is severe. Careful evaluation of soils and of productive plant materials adapted to each soil are needed to assure reasonable success in establishing new cover.

Cost-return information is needed to help determine where soils and plants will respond adequately to justify the cost of soil amendments and fertilizer. Such studies are needed to identify soils on which fertilizers cannot be used economically. For these, plants need to be found that produce forage without fertilizer. Some steep, extremely sandy, and saline soils are in this category. The exact acreage is not known but there is such land in several States.

Nearly all of the pasture land in the eastern part of the country will respond favorably to fertilizer and lime applications although some of the steep class VI and VII land does not respond enough to give economic returns.

Seed supplies of native grasses and newly introduced species have been scarce in the past. The seed trade has generally provided enough seed for broad-scale plantings of many introduced species. Until recently, however, most native grass seed was harvested from wild stands. Uncertainty of the supply and high cost of seed have limited the acreage planted and too often resulted in the use of unadapted seed.

In the Great Plains and West, greater use needs to be made of locally adapted strains of native grasses except in areas where introduced grasses can be used on irrigated land and in Southern California and the San Joaquin Valley. For tame pastures in humid areas a wide variety of locally adapted strains are needed. Some of these should be adapted to varying degrees of wetness, aridity, and fertility.

The problem of seed supplies is greatest in the range area where adapted local supplies often are scarce. Large commercial seedsmen are seldom interested in the small volume of business in providing locally adapted species for a limited market. Local growers could meet this need in many areas. Seed of the most desirable species can be produced under cultivation. In the West, irrigation farmers especially find grass seed a promising crop. In some areas soil conservation districts produce much of the grass seed needed for local use.

Seeded areas need protection from grazing until seedlings are well established. Livestock like to graze the young plants and destroy them if allowed to concentrate on them. At least one and sometimes two seasons are required to establish new grass stands on rangeland.

Once new grass is established, careful management is needed to keep it vigorous and productive. After the first 2 or 3 years, reseeded land can be managed as a part of the natural range. Newly established tame pastures can usually be grazed after the first year and sometimes in the same year that they are seeded.

**Improvement of plant cover**

Some 107.6 (107.4) million acres of pasture and range needs improvement of the plant cover by partial seeding or natural thickening of the stand by deferred grazing, by mechanical measures, or by fertilization (mainly on tame pastures) (table 42). This acreage includes areas which had the desired kinds of vegetation in 1958 but the cover was inadequate and it could be restored by measures short of complete reestablishment.

Improvement of the plant cover is needed on about 22 percent of all non-Federal pasture and range, or 30 percent of that needing treatment. Nearly 80 percent of this or 84 million acres is in the 17 Western States.

However important it may be to restore grass cover to retired cropland and denuded ranges, there are even greater opportunities to increase forage production and conserve soil and water by proper management of existing grasslands.

Both reseeded and natural grasslands need management. The opportunities for improvement and the management practices needed depend upon the kind of range or pasture and the condition of the vegetation. Fertilizer should be applied to improve plant cover on the humid pasture land that will justify the expense. Often fertilizer is used on land that will not respond with enough increase in production to repay the expense.

Introduction of forage species more productive than those ordinarily found on rundown pastures will increase yields profitably on some soils. Many of the present pastures would show economic increases in yield if they were grazed properly, freed of brush and weeds, and fertilized.

Studies are needed to identify soils inherently low in productivity that yield unprofitable returns from introduced grasses. Native plants may be the most desirable for these soils.

On ranges below excellent condition, improvement through natural seeding is quicker on moderately grazed or summer-rested ranges than on heavily grazed or summer-grazed ones. In fact, heavily grazed ranges seldom reseed naturally. Natural seeding is best on rocky, sandy, gravelly and subirrigated lands; it is poorest on hard land and on dry areas.

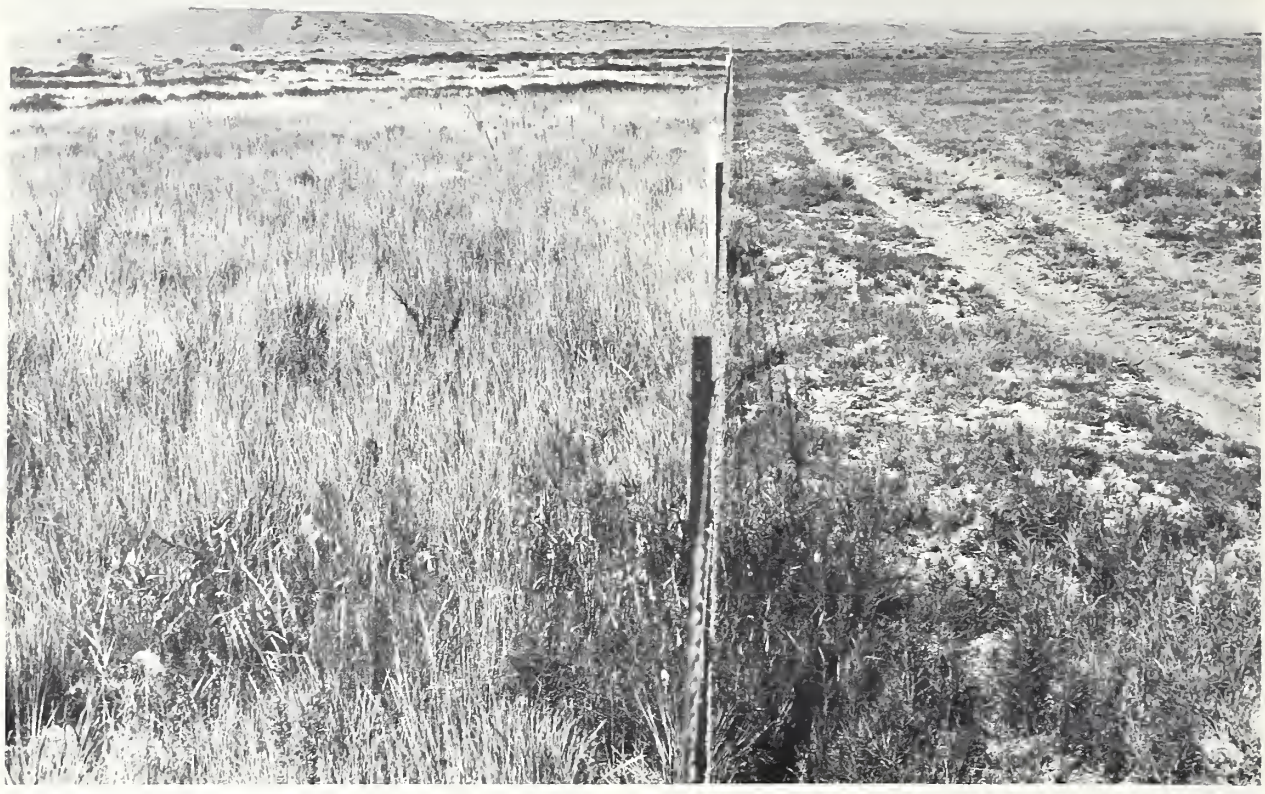
**Protection of plant cover**

In addition to the pasture and rangeland needing establishment or improvement of plant cover, 184.8 million acres or 38 percent of the total needs positive measures to protect already adequate stands of vegetation from one or more of the following hazards: overgrazing, fire, erosion, rodents, or woody and noxious plants (table 42).

Acreages that need protection from two or more of these hazards are repeated in the following discussions of different categories of plant protection. Acreages that need either establishment or improvement of plant cover, however, are not repeated in these categories since it is assumed that treatment to establish or improve cover includes the necessary protection to make the effort successful.

**Overgrazing.** Overgrazing is the most widespread hazard to established pastures and ranges (fig. 43). Of the nearly 185 million acres needing only protection of plant cover, 163.2 (163.0) million acres or 88 percent needs protection from overgrazing. In addition, the 72 million acres needing establishment of new cover and the 107 million acres needing improvement of existing cover will require protection from overgrazing to make those treatments successful. Altogether, then, about 343 million acres or 68 percent of non-Federal pasture and range needs additional protection from overgrazing. The remainder, now adequately protected, needs continued attention to maintain the protection. All grazing land, of course, needs protection from overuse at all times.

Of the 163 million acres identified in the CNI as needing only protection from over-



N. MEX-6720

*Figure 43.*—**Protection from overgrazing (left) is needed on 163 million acres in addition to the acreage needing establishment of new cover or improvement of existing stands; overgrazing (right) is the most widespread hazard to established pastures and ranges.**

grazing, nearly 158 million acres or 97 percent is in the 17 Western States. The acreage in this category in the Eastern regions is low because most of the grazing land there is tame pasture which was included in the acreages needing establishment or improvement of cover.

The Inventory may also reflect different concepts of overgrazing. Five States (Vermont, New Jersey, Wisconsin, West Virginia, and Alaska) report no pasture and range needing protection from overgrazing other than that which needs establishment or improvement of cover. Adjoining States, however, recognize overgrazing as a conservation problem.

Improvement in grazing use can usually increase production, even where soil and water are adequately protected by existing cover. Estimates by the U.S. Soil Conservation Service (USDA–LWP, 1962) indicate that less than 10 percent of privately owned range is in "excellent" condition and less than 20 percent in "good" (table 43).

According to this classification, range in "excellent" condition is producing at or near its potential (fig. 44). Range in "good" condition can be improved by 25 to 50 percent above its present condition; that in "fair" by 50 to 75 percent; and that in "poor" by 75 percent or more. In the last 15 years, conservation efforts of ranchers have improved 15 to 20 percent of the acreage of private rangeland from one condition class to the next higher.

Since most forage will continue to be harvested by grazing animals, management methods need to be found to permit range and pas-

TABLE 43.—*Condition of privately owned range*[1]

| Region [2] | Excellent | Good | Fair | Poor |
|---|---|---|---|---|
| | *Percent* | *Percent* | *Percent* | *Percent* |
| West | 5 | 15 | 30 | 50 |
| Southern Plains | 5 | 15 | 40 | 40 |
| Northern Plains | 10 | 20 | 40 | 30 |
| Southeast | 5 | 10 | 50 | 35 |

[1] USDA–LWP, 1962, table 7.

[2] Soil Conservation Service reporting regions: West—Washington, Oregon, Idaho, California, Nevada, Utah, Arizona; Southern Plains—New Mexico, Oklahoma, Texas, Arkansas, Louisiana; Northern Plains—Montana, Wyoming, Colorado, North Dakota, South Dakota, Nebraska, Kansas; Southeast—Tennessee, North Carolina, South Carolina, Mississippi, Alabama, Georgia, Florida.

WYO-643 : WYO-642 : WYO-644 : WYO-645

*Figure 44.*—More than 90 percent of the range in the United States is below its potential or "excellent" condition. These photographs show range in different conditions on the same range site. From top to bottom—excellent, good, fair, and poor.

ture plants to renew themselves while being used for grazing. As a basis for improved management systems and for the determination of range condition and trend, conservationists and ranchers need more information about inherent characteristics, growth requirements, patterns of change, and environmental interrelations of range and pasture plants. Also, they need to know more about the effects of herbage removal, fire, soil compaction, temperature and moisture fluctuations, and competition among plant species. Even more important than research, however, is the extension and application of known principles of good management.

**Fire.** About 73.1 million acres or 15 percent of non-Federal pasture and range has serious fire hazards from which the plant cover is not now adequately protected but where the installation of fire control measures would be feasible (table 42).

More than 68 million acres or nearly 95 percent of the total range and pasture needing protection from fire is in the 17 Western States.

Most of the organized fire prevention and control programs are on publicly owned range and pasture. These need to be extended to private grazing land where damage is often extensive before volunteer firefighters can be assembled and equipped. Plowed fireguards are the most common fire-prevention measure but they have little value in controlling big fires.

**Erosion.** About 32.1 (32.0) million acres of range and pasture have been gullied, seriously washed, or badly damaged by wind erosion and need treatment for erosion control (fig. 45, table 42). About 65 percent is in the Mountain region and is difficult to manage because of the steep slopes, arid lowlands, shallow soils, torrential storms, and the annual spring snowmelt

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*Figure 45.*—Sheet erosion and gullies damage rangeland that has been long overgrazed. More than 32 million acres needs erosion-control treatment of some kind.

on upper watershed areas. Proper use of forage is difficult to achieve on these ranges because the irregular topography causes animals to overgraze the easily accessible areas and avoid steeper ones.

**Rodents.** About 11.2 million acres of pasture and range is impaired by rodent damage that can be corrected by chemical, mechanical, or other measures (table 42). More than 90 percent of this acreage is in the 17 Western States.

Range rodents usually feed on broadleaved weeds that invade overgrazed ranges. Good range management, which lets the better forage grasses increase and crowd out the weeds, usually provides the most economical and most permanent control of rodents on extensive range areas. More direct methods, however, are needed on some areas to reduce rodent populations so that range grasses can improve.

#### Encroachment of Woody and Noxious Plants

About 57.1 million acres of non-Federal pasture and range shows serious encroachment of noxious and woody plants that can be removed by chemical or mechanical measures (table 42). About 85 percent of the range needing this protection is in the Mountain region and in Texas. This area, together with other grazing areas needing this protection but not reported here, (such as Federal rangeland and chaparral, pinion-juniper, woodland, and grazed forested land invaded by undesirable species), makes the total area needing protection from encroachment of plants 240 million acres.

Fairly satisfactory controls have been applied to about 54 million acres of range [10] but because of longevity of seeds and the ability of many brush species to sprout from roots, only a small area has been wholly freed of brush. Programs that provide adequate follow-up to control brush stands have resulted in large increases in grass growth. Many brush-controlled ranges are now producing 2 to 10 times as much forage as formerly. Good grass stands generally are superior to brush and scrub trees for water conservation.

#### Water management

More than 23.2 million acres of pasture and range needs water conservation measures to help establish and improve desirable plant cover. About one-half of this is in the Mountain region and about one-third in the Southern and Northern Plains (table 42).

Water spreading, pitting, and contour furrows are other practices suitable for dry range and pasture land (fig. 46).

In arid and semiarid regions, livestock water is one of the greatest conservation needs. On all U.S. pasture and rangeland 2 million stock-

MONT-174

***Figure 46.*—Water-conservation measures such as this system of diversion dams and trail dikes help to improve grass cover on arid and semiarid rangeland.**

water developments have been built and 1 million more are needed.[11]

By far the greatest per-acre forage production is obtained from irrigated pastures. Irrigation is becoming more widely used in humid pasture areas, but it cannot become widespread until installation is less expensive.

More than 11.2 million acres or 2 percent of the pasture and range has excess water that prevents the adequate establishment, maintenance, and use of desirable plant cover. About two-thirds of it is in the Southeast, Delta, and Southern Plains regions.

Drainage is a key water conservation practice on wetland pastures. Minimum drainage and development of cattle walkways is proving helpful in opening to grazing thousands of acres of marshlands, particularly in the Southeast.

## *Forest and Woodland*

Nearly a third of the non-Federal rural land in the United States is forest and woodland (fig. 47), and more than half of this needs treatment for conservation and improvement. In addition, all of it needs protection—through either improvement or maintenance of present facilities—against the hazards of fire, insects and disease, and animals.

Most of the private forest and woodland is producing wood crops at less than its capacity. Repeated cutting and fires have left much of it bare or with only a partial stand of trees. Poor cutting practices and inadequate protection have left additional acres with a high proportion of cull and diseased trees or low-quality inferior species. The encroachment of low-value hardwoods on former softwood areas and the stagnation of stands due to overstocking are problems in many areas. Among the measures needed for forest and woodland con-

[10] Soil Conservation Service records as of June 30, 1962.

[11] Unpublished records of the Soil Conservation Service.

W1S-1326

*Figure 47.*—**About a third of the non-Federal rural land in the United States is forest and woodland, much of it interspersed with cropland and pastures in farming areas.**

servation are planting, removing of cull trees, thinning, other stand improvement measures, and protection from hazards to existing stands.

## LAND USED FOR FOREST AND WOODLAND

About 452.7 million acres of forest and woodland in the 50 States including Alaska and Hawaii (449.7 million in the 48 mainland States) is owned by individuals or by local governments. The Conservation Needs Inventory (CNI) is concerned only with this non-Federal rural acreage. It is about 60 percent of the 773.8 (639.5) million acres of both private and public forest land (Wooten 1962) and is distributed as shown in table 44.

TABLE 44.—*Forest and woodland in the United States*

| Region | Non-Federal forest and woodland [1] 1958 | Total forest and woodland [2] 1959 |
|---|---|---|
| | *1,000 acres* | *1,000 acres* |
| Northeast | 65,913 | 66,892 |
| Lake States | 46,474 | 54,614 |
| Corn Belt | 28,078 | 31,349 |
| Northern Plains | 3,672 | 5,377 |
| Appalachian | 64,014 | 70,202 |
| Southeast | 70,392 | 77,860 |
| Delta States | 48,559 | 54,170 |
| Southern Plains | 33,737 | 38,150 |
| Mountain | 42,165 | 144,288 |
| Pacific | 46,647 | 96,580 |
| U.S. mainland | 449,651 | 639,482 |
| Alaska | 1,098 | 132,314 |
| Hawaii | 1,980 | 2,000 |
| U.S. total | 452,729 | 773,796 |

[1] Conservation needs inventory (USDA–CNI 1962).
[2] U.S. census.

Both the Conservation Needs Inventory and the Timber Resources Review of the U.S. Forest Service define forest and woodland by the same standards:

"(a) Land which has at least 10 percent canopy of forest trees of any size capable of producing timber or other wood products or capable of exerting an influence on the water regime; (b) Land from which the trees described in (a) have been removed to less than 10 percent canopy and which have not been developed for other uses; (c) afforested (planted) areas; and (d) chaparral areas."

This definition includes in forest and woodland a large acreage of chaparral and lowgrade woodland although much of this land is used for grazing rather than wood crop production. The CNI, however, does not reflect needs for range-conservation treatments on land reported as forest and woodland. Protection measures, on the other hand, are applicable for preserving soil, watersheds, forage, wildlife, and other values.

## EXPECTED CHANGES IN FOREST AND WOODLAND

The estimates of conservation treatments needed on forest and woodland were made for the acreages expected to be in that use by 1975, including newly established woodland. Local CNI committees projected local trends in land use changes and estimated acreages likely to be converted *from* and *to* forest and woodland. Land-capability information obtained in the Inventory was used in these estimates.

### Net changes

The net effect of the expected changes is a reduction of about 10 million acres in the total non-Federal forest and woodland, or a decline of about 2 percent (table 45). A total of 29.0 (28.7) million acres is expected to be converted from forest and woodland to other uses by 1975, and 18.8 (18.7) million acres is expected to come into forest and woodland from other uses.

In all regions some woodland is expected to be shifted to other uses. During the last two decades, such changes have been motivated by economic pressures and improvements in technology, and they are likely to continue.

The largest net reduction in any region will be about 5.6 million acres or 17 percent in the Southern Plains where much of the present low-grade woodland will be converted to pasture and range.

The Southeast, Northeast, and Appalachian regions will have the largest acreages coming into forest and woodland from other uses. In each of these regions, the new woodland is expected to exceed 3 million acres.

TABLE 45.—*Expected changes in forest and woodland, 1958 to 1975*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | Forest and woodland, 1958 | Going out of forest and woodland | Coming into forest and woodland | Net change | |
|---|---|---|---|---|---|
| | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *Percent of 1958* |
| Northeast | 65,913 | 1,701 | 3,355 | + 1,654 | + 3 |
| Lake States | 46,474 | 2,088 | 1,817 | — 271 | — 1 |
| Corn Belt | 28,078 | 3,396 | 2,087 | — 1,309 | — 5 |
| Northern Plains | 3,672 | 448 | 384 | — 64 | — 2 |
| Appalachian | 64,014 | 3,270 | 3,263 | — 7 | 0 |
| Southeast | 70,392 | 4,112 | 4,608 | + 496 | + 1 |
| Delta States | 48,559 | 3,475 | 1,728 | — 1,747 | — 4 |
| Southern Plains | 33,737 | 5,985 | 381 | — 5,604 | —17 |
| Mountain | 42,165 | 2,086 | 473 | — 1,613 | — 4 |
| Pacific | 46,647 | 2,128 | 627 | — 1,501 | — 3 |
| U.S. mainland | 449,651 | 28,691 | 18,722 | — 9,969 | — 2 |
| Alaska | 1,098 | 106 | 1 | — 105 | |
| Hawaii | 1,980 | 173 | 42 | — 131 | — 7 |
| U.S. total | 452,729 | 28,970 | 18,764 | —10,206 | — 2 |

**Land coming into forest and woodland**

The nearly 19 million acres expected to be converted to forest and woodland by 1975 will add to the conservation work needed. It will need to be planted to establish new stands of trees and will need appropriate protective measures.

About equal amounts of the new forest and woodland will come from present cropland, from pasture and range, and from other land (table 46). About 0.9 million acres will come into private ownership through projects developed by the U.S. Department of the Interior.

The new forest and woodland will be about equally divided between land suitable for cultivation (capability classes I–III) and that unsuitable (classes V–VIII), 38 percent or 7.1 million acres in the former category and 41 percent or 7.7 million acres in the latter. In addition, 21 percent or 3.9 million acres will be class IV land, which is marginal for cultivation (table 47).

TABLE 46.—*Former land use of land expected to be in forest and woodland by 1975*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | Remaining in forest and woodland | Coming into forest-woodland | | | | Total new forest and woodland | Total forest and woodland, 1975 |
|---|---|---|---|---|---|---|---|
| | | Cropland | Pasture and range | Other land | Public land [1] | | |
| | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* |
| Northeast | 64,212 | 932 | 1,129 | 1,275 | 19 | 3,356 | 67,568 |
| Lake States | 44,386 | 818 | 499 | 439 | 61 | 1,817 | 46,203 |
| Corn Belt | 24,682 | 611 | 880 | 595 | 1 | 2,086 | 26,768 |
| Northern Plains | 3,223 | 280 | 85 | 19 | 0 | 384 | 3,607 |
| Appalachian | 60,744 | 916 | 1,339 | 1,008 | 1 | 3,263 | 64,007 |
| Southeast | 66,280 | 1,909 | 1,194 | 1,389 | 115 | 4,608 | 70,888 |
| Delta States | 45,084 | 821 | 504 | 403 | 0 | 1,727 | 46,811 |
| Southern Plains | 27,752 | 197 | 82 | 103 | 0 | 381 | 28,133 |
| Mountain | 40,079 | 30 | 170 | 6 | 267 | 472 | 40,551 |
| Pacific | 44,519 | 69 | 133 | 5 | 419 | 627 | 45,146 |
| U.S. mainland | 420,961 | 6,582 | 6,014 | 5,242 | 883 | 18,721 | 439,682 |
| Alaska | 992 | 1 | 0 | 0 | 0 | 1 | 992 |
| Hawaii | 1,808 | 3 | — | 39 | 0 | 42 | 1,849 |
| U.S. total | 423,760 | 6,585 | 6,014 | 5,281 | 883 | 18,764 | 442,524 |

[1] This is mostly forest and woodland coming into private ownership through Department of the Interior projects.

TABLE 47.—*Land capability of land expected to come into forest and woodland by 1975*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | Class I–III | | Class IV | | Class V–VIII | | Total | |
|---|---|---|---|---|---|---|---|---|
| | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* |
| Northeast | 1,487 | 44 | 658 | 20 | 1,210 | 36 | 3,356 | 100 |
| Lake States | 592 | 33 | 622 | 34 | 603 | 33 | 1,817 | 100 |
| Corn Belt | 571 | 28 | 403 | 19 | 1,113 | 53 | 2,086 | 100 |
| Northern Plains | 271 | 71 | 31 | 8 | 82 | 21 | 384 | 100 |
| Appalachian | 679 | 21 | 521 | 16 | 2,062 | 63 | 3,263 | 100 |
| Southeast | 2,470 | 54 | 1,199 | 26 | 939 | 20 | 4,608 | 100 |
| Delta States | 831 | 48 | 298 | 17 | 599 | 35 | 1,727 | 100 |
| Southern Plains | 152 | 40 | 92 | 24 | 137 | 36 | 381 | 100 |
| Mountain | 24 | 5 | 26 | 5 | 423 | 90 | 472 | 100 |
| Pacific | 38 | 6 | 61 | 10 | 528 | 84 | 627 | 100 |
| U.S. mainland | 7,115 | 38 | 3,911 | 21 | 7,696 | 41 | 18,722 | 100 |
| Alaska | 0 | — | 0 | — | 1 | 100 | 1 | 100 |
| Hawaii | 5 | 12 | 5 | 12 | 32 | 76 | 42 | 100 |
| U.S. total | 7,120 | 38 | 3,916 | 21 | 7,729 | 41 | 18,765 | 100 |

**Forest and woodland on wet soils.** About a fifth of the non-Federal forest and woodland or 98.8 (98.2) million acres is on wet soils (land capability subclass w) (table 48). Recent experience in soil conservation districts shows that drainage or other forms of water management can improve woodcrop production on some of these soils.

The Southeast, Lake States, and Delta States have the largest acreages of forest and woodland on wet soils. The acreages are expected to decline by 1975 in all regions except the Northeast. The total in 1975 is expected to be about 93.4 (92.9) million acres or 5 percent less than in 1958.

TABLE 48.—*Forest and woodland on wet soil 1958 and 1975*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | 1958 | 1975 | Net change | |
|---|---|---|---|---|
| | *1,000 acres* | *1,000 acres* | *1,000 acres* | *Percent* |
| Northeast | 9,369 | 9,896 | + 527 | + 6 |
| Lake States | 19,086 | 18,676 | — 411 | —10 |
| Corn Belt | 4,475 | 3,456 | —1,019 | —23 |
| Northern Plains | 760 | 665 | — 95 | —13 |
| Appalachian | 11,648 | 11,016 | — 633 | — 5 |
| Southeast | 26,156 | 25,642 | — 514 | — 2 |
| Delta States | 18,799 | 17,016 | —1,764 | —10 |
| Southern Plains | 6,804 | 5,535 | —1,269 | —19 |
| Mountain | 491 | 447 | — 44 | — 9 |
| Pacific | 674 | 534 | — 140 | —21 |
| U.S. mainland | 98,243 | 92,926 | —5,317 | — 5 |
| Alaska | 310 | 283 | — 27 | — 9 |
| Hawaii | 219 | 208 | — 11 | — 5 |
| U.S. total | 98,771 | 93,417 | —5,355 | — 5 |

## FOREST AND WOODLAND NEEDING CONSERVATION TREATMENT

More than half of the non-Federal forest and woodland, including land to be newly established in this use by 1975, needs establishment or improvement of timber stand (fig. 48, table 49). An even greater proportion, largely overlapping in acreage, needs improved protection from fire, insects, and other hazards (table 49). About 69.7 (68.8) million acres or 16 percent of the 441.5 (439.7) million acres of forest and woodland needs stand establishment by planting or natural regeneration; in addition, 160.3 (160.2) million acres or 36 percent needs stand improvement by thinning, pruning, or other cultural treatment. About 252.4 (252.1) million acres needs improved fire protection, and 207.0 (206.7) million acres needs better safeguards from insects and disease. One-fifth of the total, or 82.5 (82.2) million acres, needs protection against animals.

Of the 242 million acres of non-Federal forest and woodland needing treatment, the largest acreage (57.4 million acres) as well as the highest proportion (81 percent) is in the Southeast. Other regions where more than half needed treatment were the Delta States, 32.8 million acres or 70 percent; Lake States, 26.8 million acres or 58 percent; and Appalachian, 34.7 million acres or 54 percent.

All non-Federal forest and woodland acreages were considered in estimating needs for protection but only those with significant income-producing potential were considered for establishing and improving the timber stand. Parks, recreation areas, and other areas not used for timber were excluded from the estimates of conservation needs.

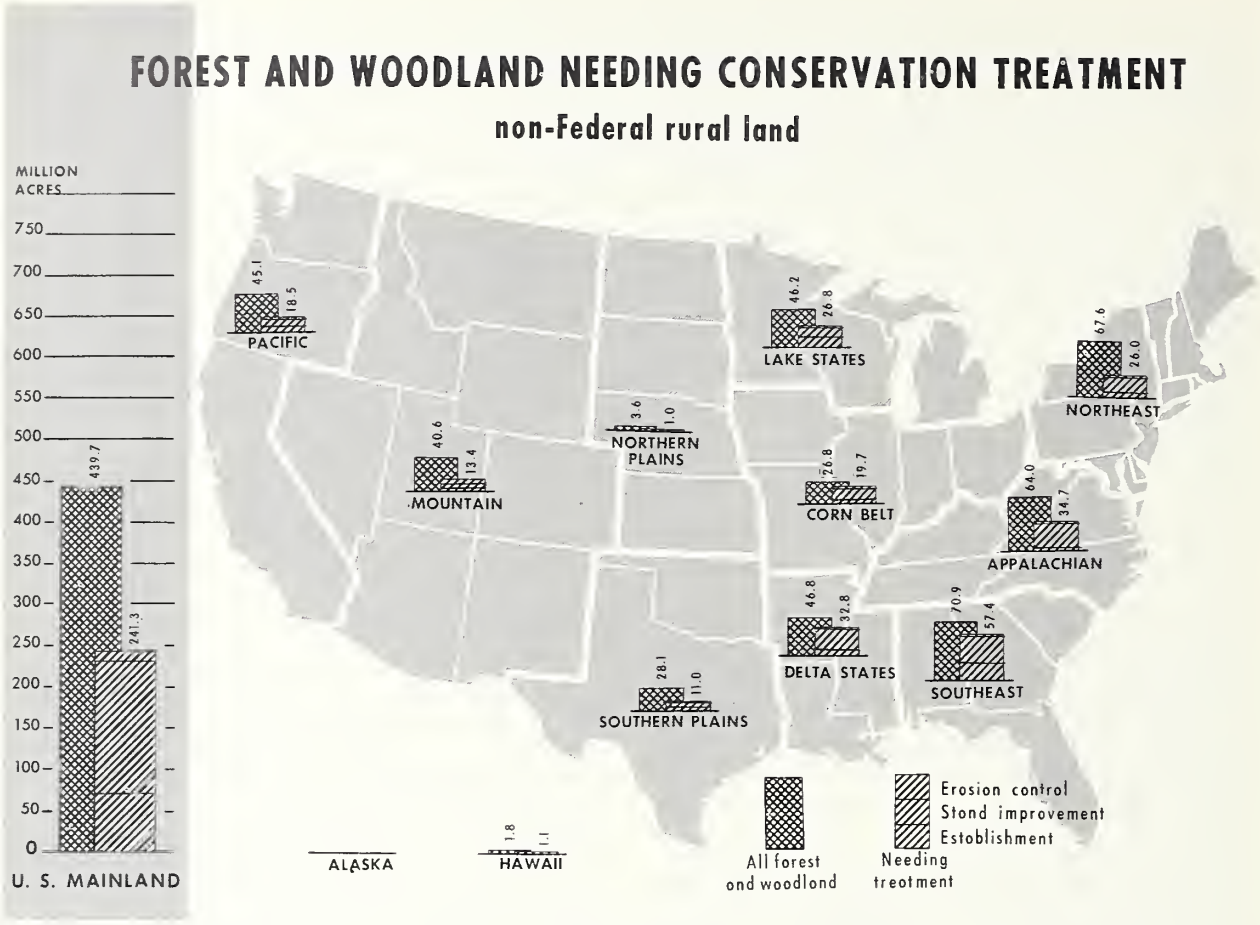


*Figure 48.*

TABLE 49.—*Non-Federal forest and woodland needing*

[Because of rounding, some totals may not equal the sum of the

| Region | Total forest-woodland 1975 | Needing treatment [2] | | | | | |
|---|---|---|---|---|---|---|---|
| | | Not needing treatment [1] | | Establishment of stand | | Improvement of stand | |
| | *1,000 acres* | *1,000 acres* | *Percent [3]* | *1,000 acres* | *Percent [3]* | *1,000 acres* | *Percent [3]* |
| Northeast | 67,568 | 41,570 | 62 | 5,877 | 9 | 19,798 | 29 |
| Lake States | 46,204 | 19,396 | 42 | 11,670 | 25 | 14,986 | 32 |
| Corn Belt | 26,769 | 7,063 | 26 | 5,217 | 20 | 13,485 | 50 |
| Northern Plains | 3,607 | 2,631 | 73 | 295 | 8 | 633 | 18 |
| Appalachian | 64,006 | 29,317 | 46 | 7,447 | 12 | 26,180 | 41 |
| Southeast | 70,888 | 15,007 | 19 | 20,588 | 29 | 35,443 | 50 |
| Delta States | 46,811 | 13,969 | 30 | 6,039 | 13 | 26,122 | 56 |
| Southern Plains | 28,133 | 17,123 | 61 | 3,272 | 12 | 7,617 | 27 |
| Mountain | 40,550 | 27,158 | 67 | 2,323 | 6 | 6,019 | 15 |
| Pacific | 45,146 | 26,654 | 59 | 6,120 | 14 | 9,927 | 22 |
| U.S. mainland | 439,682 | 199,885 | 45 | 68,848 | 16 | 160,210 | 36 |
| Alaska | ([5]) | ([5]) | — | — | — | — | — |
| Hawaii | 1,849 | 787 | 43 | 808 | 44 | 50 | 3 |
| U.S. total | 441,531 | 200,672 | 45 | 69,656 | 16 | 160,260 | 36 |

[1] Total forest and woodland less the total acreage needing treatment.

[2] Requiring on-site work on the land.

[3] Of total forest and woodland.

[4] Includes 1,512,000 acres reported as needing both establishment and reinforcement of timber stand and improvement of timber stand.

[5] Acreage of private forest and woodland in Alaska

**Establishment of timber stand**

Establishment of timber stand is needed on nearly 70 million acres or 16 percent of the non-Federal forest and woodland (table 49). This includes (1) planting seedlings (fig. 49), direct seeding on nonstocked land, or reinforcement planting in poorly stocked stands, and (2) seedbed preparation to facilitate natural regeneration.

The acreage estimated to be in need of planting consists of (1) land now in other uses but expected to be shifted to forest and woodland by 1975—amounting, for the Nation as a whole, to about 10 million acres; (2) land now classified as forest and woodland with less than 10 percent stocking or now stocked with undesirable species but economically convertible to desirable species, and (3) land with more than 10- but less than 40-percent stocking in need of reinforcement through planting or natural regeneration. Acreages needing reinforcement were converted to the estimated equivalent in area needing complete planting.

The greatest need for stand establishment is in the Southeast where it is required on 20.6 million acres or 29 percent of the total non-Federal forest and woodland. In the Lake States new stands are needed on 11.7 million acres or 25 percent of the woodland, and in the Corn Belt on 5.2 million acres or 20 percent. This need is least extensive in the Mountain, Northern Plains, and Southern Plains regions.

Success is conditioned by many local factors. Soil and site characteristics, condition of existing vegetation or forest floor, species selection and their individual silvicultural requirements, hazards to the soil and to the crop during establishment from treatment operations and

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***Figure 49.*—Mechanical planters are used to speed up the planting of pine seedlings.**

*conservation treatment and improved protection by 1975*

items listed and data may not check exactly with summary tables]

| Erosion control | | Total | | Needing protection from [6] Fire | | Insects and disease | | Animals | |
|---|---|---|---|---|---|---|---|---|---|
| *1,000 acres* | *Percent* [3] | *1,000 acres* | *Percent* [3] | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* |
| 323 | 1 | 25,998 | 38 | 22,572 | 33 | 23,626 | 35 | 3,172 | 5 |
| 152 | — | 26,808 | 58 | 13,165 | 28 | 22,321 | 48 | 17,043 | 37 |
| 1,005 | 4 | 19,706 | 74 | 15,490 | 58 | 22,674 | 85 | 14,247 | 53 |
| 48 | 1 | 976 | 27 | 952 | 26 | 878 | 24 | 982 | 27 |
| 1,062 | 2 | 34,689 | 54 | 41,389 | 65 | 27,045 | 42 | 7,522 | 12 |
| 1,362 | 2 | [4] 57,392 | 81 | 62,307 | 88 | 50,707 | 72 | 9,931 | 14 |
| 681 | 2 | 32,842 | 70 | 38,392 | 82 | 35,244 | 75 | 11,119 | 24 |
| 121 | — | 11,010 | 39 | 11,257 | 40 | 10,422 | 37 | 3,148 | 11 |
| 5,050 | 12 | 13,392 | 33 | 24,424 | 60 | 13,830 | 34 | 6,818 | 17 |
| 2,446 | 5 | 18,494 | 41 | 22,186 | 60 | 0 | — | 8,235 | 18 |
| 12,250 | 3 | 241,309 | 55 | 252,135 | 57 | 206,747 | 47 | 82,217 | 19 |
| — | — | ([5]) | — | ([7]) | | ([7]) | | ([7]) | |
| 204 | 11 | 1,062 | 57 | 227 | 12 | 234 | 13 | 277 | 15 |
| 12,454 | 3 | 242,371 | 55 | 252,362 | 57 | 206,981 | 47 | 82,494 | 19 |

by 1975 will depend on State's selection of land granted under Statehood Act.

[6] The same acreage may need improved protection from two or more types of hazards and may be included in acreage needing on-site treatment.

[7] Data not available.

from natural causes must all be considered on an area-by-area basis.

**Improvement of timber stand**

About 160.2 million acres or 36 percent of non-Federal forest and woodland needs timber-stand-improvement measures (table 49). More than half of this acreage is in the Appalachian, Southeast, and Delta States regions; most of the remainder is in the Northeast, Lake States, and Corn Belt.

Timber-stand-improvement measures include keeping the stand from becoming too thick or too thin, taking out cull and weed trees, pruning crop trees, and releasing desirable trees from competing undesirable vegetation. Such improvement cuttings must be varied, since forest stands vary with such factors as age, species composition, stocking, vigor or health, and also kinds of soil and physiographic situations. Although nearly every stand can benefit from it, improvement cutting may not be practicable because of cost in relation to return.

Precommercial thinnings, cull removal, pruning, and release cuttings seldom provide marketable materials, so the landowner cannot retrieve his cost at the time of treatment. Rather, he is making an investment for the future. Improvement cuttings made later in the life of a stand do provide marketable material. Even some trees of inferior species or poor form or with defects caused by insects and diseases may be large enough when removed to be sold.

Timber stand improvements should be planned tract-by-tract when the operation is begun. Potential soil productivity for the wood crop is then known, or can be determined directly, through appropriate soil-woodland interpretations provided by a modern soil survey. Costs of needed treatments can be estimated on the basis of current facts and stand conditions. Timber stand improvements can then be done with a minimum of assumptions and with the greatest assurance that results will be economically feasible.

**Erosion control**

Non-Federal forest and woodland on which erosion-control and water-disposal measures are needed and feasible (fig. 50) amounts to 12.5 (12.3) million acres or about 3 percent of the total (table 49). The measures are needed to check gullies, control sheet erosion, stabilize dunes and blowouts, contain slides or slide areas, and control logging-road and skid-trail erosion. This acreage includes gullied land and eroded areas expected to be planted to trees to control erosion and make effective use of the soil but not areas needing shelterbelts and windbreaks for wind-erosion control, which are reported separately.

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*Figure 50.*—**Special erosion-control measures are needed on a small percentage of non-Federal forest and woodland, such as this gully formed in an abandoned logging road.**

Erosion hazards on forest and woodland are usually periodic and are most critical on areas during planting, cutting, or harvesting. Such operations, usually attended by soil or ground-cover disturbance, may occur every few years or at infrequent intervals during the life of a forest, depending upon variable factors such as soil and site characteristics, kinds of trees, economic circumstances dealing with markets, and the wishes of the owner or operator. Indiscriminate use of equipment at these times can result in serious damage to the site and loss of potential wood production, especially on the more erosive soils and on steep slopes. Some very effective and practical steps can be taken to eliminate or minimize erosion at these times, but these steps need to be planned locally with full recognition given to soil, slope, type of equipment, and methods of its operation. Much practical information is available for the special problems of controlling erosion on dunes and blowouts and of containing slides or slide areas.

More than half of the forest and woodland needing erosion control is in the Mountain and Pacific regions where the proportion of steep land is greatest. Extensive areas in the Southeast, Appalachian, and Corn Belt regions also

need erosion control. Compared with other woodland conservation needs, erosion control is minor in the other regions.

**Protection of timber stand**

The CNI estimated acreages of non-Federal forest and woodland not adequately protected under current programs. The acreages reported are not the same as those needing planting or timber stand improvement and overlap with them to an undetermined extent.

**Fire.**—More than 252 million acres or 57 percent of the non-Federal forest and woodland needs improved protection from fire (table 49). This includes only acreage considered to have serious fire hazards and not currently receiving adequate protection.

Fire takes a heavy toll from our forests every year. Trees are killed and areas denuded; stands are thinned and weakened and made subject to attacks by insects and diseases; growth is reduced and timber quality is impaired. In addition, fires cause soil depletion, create erosion hazards, destroy wildlife habitat, and impair outdoor recreation attractions.

Effective fire control requires an organization that is strong enough to cope with the situation in the worst years and under critical conditions. Organizations capable of meeting the situation in average years may not be adequate in the critical year that may occur once or twice each decade.

"Adequate protection" has had wide interpretation. Some States that have a comparatively efficient fire-protection organization considered it inadequate to meet the tests of critical years and estimated that a high percentage of forest and woodland acreage needed intensified protection. In other States, where establishing and financing a State system of fire protection have been difficult, the acreage still needing intensified protection was estimated as comparatively small. Such low estimates apparently reflect the conviction that "protection fully adequate for the *worst years*" is not yet a practical objective for them.

**Insects and disease.**—Nearly half or 47 percent of the non-Federal forest and woodland needs improved protection from insects and disease. A total of 207.0 (206.7) million acres needs intensified programs (table 49).

Because insect and disease outbreaks are unpredictable, all forest land must be continuously observed so that control measures can be taken promptly. An effective program provides for periodic detection surveys and for initiating control measures, where feasible, after an insect or disease outbreak has been discovered. State and private owners have recognized the importance of detection surveys and, in many parts of the country, have organized forest pest-control councils to encourage adequate surveys and the participation of private owners in control work.

Like fire protection needs, this concept was variably interpreted, and estimates may be low. They show, however, that large proportions—more than 70 percent—of forest and woodlands in the Corn Belt, Delta States, and Southeast lack adequate protection from insects and diseases.

**Animals.**—About 82.5 (82.2) million acres or 20 (19) percent of the non-Federal forest and woodland needs more intensified protection from damage by animals, including rodents (table 49).

Many kinds of wild and domestic animals prevent successful growth and regeneration of desirable trees. Trampling, browsing, and other disturbances kill or deform many trees, which leads to loss of timber products and exposure of soil to erosion.

Domestic animals can usually be kept from forest areas by fences. Where wildlife and rodents cause damage, direct control methods such as trapping, snaring, shooting, and the use of poisons and repellents are effective. In some cases game management is the only feasible means of control. Although some conservation measures may be applied by individual owners, success is often contingent upon group action coordinated with public or private programs of much broader scope.

Protection from animals appears to be more important in the Corn Belt, Lake States, Northern Plains, and Delta States than elsewhere, although it is a conservation need in all regions.

**Establishment of shelterbelts and windbreaks**

The CNI shows that about 1.1 million acres of new shelterbelts and windbreaks are needed by 1975. (The Inventory does not cover areas of shelterbelts and windbreaks already established and considered adequate.)

Establishment of shelterbelts and windbreaks is needed mainly in the Northern Plains and Lake States, and to some extent in all other regions except the Delta States, as shown in the following tabulation:

| *Region* | *Thousand acres* |
|---|---|
| Northeast | 14 |
| Lake States | 353 |
| Corn Belt | 97 |
| Northern Plains | 382 |
| Appalachian | 26 |
| Southeast | 64 |
| Delta States | -- |
| Southern Plains | 81 |
| Mountain | 17 |
| Pacific | 25 |
| U.S. mainland | 1,059 |
| Hawaii | 2 |
| U.S. total | 1,061 |

Effective species, planting stock, and reliable cultural techniques for the different kinds of soils and local physiographic conditions are generally available to insure success.

**Improved naval stores methods**

The naval stores industry is confined to the Southeast and Delta States where, by 1975, it is estimated that the application of improved methods will be needed on about 4.2 million acres (4,040,000 in the Southeast and 142,000 in the Delta States). This acreage represents a large proportion of all of the pine type now considered suitable for commercial gum operations. However, the longleaf-slash pine timber type in the forests of the naval stores belt extending from the Carolinas to Texas totals about 25 million acres.[12] About 5 million acres of this now has timber stands with sufficient stocking of large pines (15 to 20 longleaf or slash pine per acre averaging 9 inches d.b.h. or larger) to be suitable for commercial gum operations. Depending on economic conditions and needs for this industry it is believed that improved naval stores methods could bring a larger acreage into commercial operations than that expected by 1975 according to the Inventory. Trees on less than 1.5 million acres were worked for naval stores in 1960.

Gum naval stores are the derivatives of the crude gum—oleoresin—that comes from living pine trees. The face or bark of selected trees is scarified or "chipped," acid is applied to stimulate the flow of resin, and the resin is collected in tin cups attached to the tree with nails. Improved methods of chipping and use of retractable nails minimizes damage to trees. Improved methods also provide for careful selection of larger and healthier trees for subsequent grooming to sawlog size and for the protection of tapped trees from fire, insects, and disease.

## *Other Land in Agriculture*

In the Conservation Needs Inventory (CNI) all non-Federal rural land that could not be classified as cropland, pasture and range, or forest and woodland, was placed in one heterogeneous group and classified as "other land." Although this land comprises but a small part of the nation's agricultural land, its treatment problems are significant and are increasing in importance.

"Other land" includes farmsteads, farm roads, idle land, wildlife areas, recreation developments, and other areas closely associated with agricultural use but not devoted to growing major agricultural products. Some of it is idle land formerly used for cultivated crops or tame pasture that is not yet reestablished in grass or trees or put to other uses (fig. 51).

### LAND IN OTHER AGRICULTURAL USES

About 67.0 million acres in the 50 States (66.3 million in the 48 mainland States) was classified as "other land" in 1958 (table 50). This amounted to 4.6 percent of the non-Federal rural land. Local CNI committees estimating land use trends in 1958 expected this acreage to decline to 60.5 (59.7) million acres, or 4.2 percent of the total by 1975. The reduction would amount to about 10 percent of the acreage in this category at the time of the Inventory.

This estimate however, was made before the issuance of the report of the Outdoor Recreation Resources Review Commission and the


ILL-2091

***Figure 51.*—Former cropland no longer used for crops and not yet established in any other use is included in "other land" and much of it needs treatment. This kind of land is common in urban-fringe areas where it is being held for sale.**

[12] Unpublished data from a study by the U.S. Forest Service and other agencies of the Department of Agriculture.

TABLE 50.—*"Other land" in the Conservation Needs Inventory*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | 1958 | Expected by 1975 | Net change | |
|---|---|---|---|---|
| | *1,000 acres* | *1,000 acres* | *1,000 acres* | *Percent* |
| Northeast | 7,832 | 7,064 | — 768 | —10 |
| Lake States | 9,101 | 8,763 | — 338 | — 4 |
| Corn Belt | 8,533 | 7,857 | — 676 | — 8 |
| Northern Plains | 2,467 | 2,410 | — 57 | — 2 |
| Appalachian | 6,148 | 5,018 | —1,130 | —18 |
| Southeast | 8,312 | 5,116 | —3,196 | —38 |
| Delta States | 4,724 | 4,191 | — 533 | —11 |
| Southern Plains | 2,945 | 2,712 | — 233 | — 8 |
| Mountain | 8,680 | 8,929 | + 249 | + 3 |
| Pacific | 7,528 | 7,679 | + 151 | + 2 |
| U.S. mainland | 66,271 | 59,739 | —6,532 | —10 |
| Alaska | 146 | 140 | — 6 | — 4 |
| Hawaii | 626 | 625 | — 1 | — |
| U.S. total | 67,042 | 60,504 | —6,538 | —10 |

passage of the Food and Agriculture Act of 1962 assigning new responsibilities for rural recreation to the U.S. Department of Agriculture (USDA).

In the 1963 fiscal year, before USDA could fully assume its new responsibilities, 945 cooperators of soil conservation districts converted 237,691 acres to income-producing recreation enterprises and 1,562 other cooperators made plans to convert another 511,780 acres to this use.[13] Current trends suggest that the decline in "other land" indicated by the Inventory may not materialize; that, in fact, there may be an increase in rural land not used for cultivated crops, pasture and range, or forest and woodland.

"Other land" is distributed rather evenly in all regions in relation to their size except for the Plains and Mountain regions where it makes up only 1.3 to 3.2 percent of the non-Federal rural land. It is most significant in the heavily populated Lake States, Northeast, and Pacific regions where it makes up from 6.7 to 8 percent.

External factors often are more important than the natural capability of land itself in determining its use as "other land." The single exception is land in capability class VIII, which has such extreme limitations that it is useful chiefly for wildlife habitat, watershed protection, and recreation. Two-thirds of the class VIII land is "other land" in the Inventory (table 11).

More than a fourth of the "other land," about 18 million acres, is of class VIII (table 51). Of this, a little over 4 million acres, nearly one-fourth, is extremely wet (subclass w) and useful mainly for aquatic wildlife (fig. 52). More than half, some 10.6 million acres, is made up of rough and mountainous terrain lacking enough good soil for agricultural use (subclass s). On nearly a million additional acres the climate is too severe (subclass c) for productive use. Another 2⅓ million acres are adapted only to wildlife and recreational use because of the severe actual or potential erosion (subclass e).

Classes VI and VII have the smallest proportion in "other land," mainly due to their great extent in the sparsely settled Plains and Mountain regions where "other" use is low. Classes I to IV have from 3 to 4 percent in "other" uses.

## CONSERVATION TREATMENT NEEDS

The CNI provided estimates of conservation treatment needs for other land in much the same way as for cropland, that is, according to the major problems of erosion, excess water, unfavorable soil, and adverse climate. It should be noted, however, that "other land" is not subject to problems that accompany tillage, that some of the acreage is of such low potential for productive use that treatment may not be economically feasible, and that problems of "other land" affecting nearby cropland, pasture and range, or forest and woodland have been considered in the estimates for those land uses.

About 10.4 (10.3) million acres of the "other land" needs conservation treatment (table 52).

The land needing treatment makes up about 17 percent of the "other land" in the United States. About 98 percent of the total area or 59.6 (58.6) million acres has some kind of

MINN-1713

*Figure 52.*—**Wetland useful mainly for wildlife is one of the many kinds of rural land included in the category "other land."**

[13] Unpublished records of the Soil Conservation Service.

TABLE 51.—*Land capability of "other land," 1958*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | Class I | Class II | Class III | Class IV | Class V | Class VI | Class VII | Class VIII | Total |
|---|---|---|---|---|---|---|---|---|---|
| | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* |
| Northeast | 147 | 1,751 | 2,102 | 1,196 | 13 | 869 | 827 | 904 | 7,808 |
| Lake States | 111 | 1,797 | 2,380 | 1,848 | 733 | 347 | 466 | 1,416 | 9,098 |
| Corn Belt | 393 | 3,036 | 2,330 | 1,000 | 154 | 641 | 898 | 80 | 8,533 |
| Northern Plains | 94 | 747 | 671 | 158 | 12 | 258 | 58 | 468 | 2,467 |
| Appalachian | 76 | 1,173 | 1,140 | 975 | 10 | 854 | 1,176 | 612 | 6,017 |
| Southeast | 102 | 1,077 | 2,903 | 1,104 | 638 | 773 | 886 | 817 | 8,300 |
| Delta States | 72 | 625 | 708 | 281 | 118 | 120 | 424 | 2,367 | 4,714 |
| Southern Plains | 63 | 454 | 670 | 417 | 124 | 295 | 901 | 22 | 2,945 |
| Mountain | 86 | 250 | 379 | 275 | 25 | 468 | 619 | 6,576 | 8,679 |
| Pacific | 103 | 364 | 556 | 574 | 4 | 280 | 1,214 | 4,434 | 7,529 |
| U.S. mainland | 1,247 | 11,275 | 13,839 | 7,828 | 1,832 | 4,904 | 7,469 | 17,697 | 66,271 |
| Alaska | 0 | 3 | 4 | 2 | 0 | 33 | 86 | 14 | 140 |
| Hawaii | 0 | 2 | 8 | 8 | 0 | 57 | 126 | 425 | 626 |
| U.S. total | 1,247 | 11,279 | 13,854 | 7,838 | 1,832 | 4,995 | 7,682 | 18,136 | 67,042 |

conservation problem, but since much of this land is not expected to be used intensively it was estimated that only 1 acre in 6 would require some kind of conservation treatment.

Of the four types of conservation problems, the most widespread is erosion, which is the dominant problem on nearly 23.0 (22.9) million acres or 38 percent of the total acreage (table 53). The acreages having excess water and unfavorable soil as the dominant problem each amount to more than one-fourth of the total, or 15.7 (15.6) and 16.9 (16.4) million acres respectively. Adverse climate is the dominant problem on 3.8 (3.7) million acres or 6 percent of the total.

Treatment will emphasize improvements for home living, wildlife habitat, and recreational facilities. About 2.4 million acres of wetland needs water control and vegetative development for wildlife and recreation. About 4.8 million acres requires erosion control, including roadbank and minespoil revegetation, seedings and plantings for wildlife habitat, water impoundments, tree plantings, farmstead windbreaks, and perennial grass cover. Another 3 million acres having unfavorable soil conditions needs correction with protection from fire and grazing and also needs revegetation.

The importance of these acres of "other

TABLE 52.—*Conservation treatment needed on "other land"*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | Total other land | Land having any problem | | Needing treatment | | Not needing treatment | |
|---|---|---|---|---|---|---|---|
| | *1,000 acres* | *1,000 acres* | *Percent* | *1,000 acres* | *Percent* [1] | *1,000 acres* | *Percent* [1] |
| Northeast | 7,065 | 6,920 | 98 | 1,137 | 16 | 5,928 | 84 |
| Lake States | 8,790 | 8,629 | 98 | 1,358 | 15 | 7,432 | 85 |
| Corn Belt | 7,857 | 7,511 | 98 | 1,559 | 20 | 6,298 | 80 |
| Northern Plains | 2,410 | 2,323 | 96 | 459 | 19 | 1,953 | 81 |
| Appalachian | 5,018 | 4,947 | 99 | 1,318 | 26 | 3,700 | 74 |
| Southeast | 5,116 | 5,047 | 99 | 1,118 | 22 | 3,998 | 78 |
| Delta States | 4,191 | 4,121 | 99 | 1,136 | 27 | 3,055 | 73 |
| Southern Plains | 2,712 | 2,663 | 98 | 1,034 | 38 | 1,678 | 62 |
| Mountain | 8,929 | 8,850 | 99 | 595 | 7 | 8,334 | 93 |
| Pacific | 7,678 | 7,581 | 99 | 600 | 8 | 7,078 | 92 |
| U.S. mainland | 59,766 | 58,594 | 98 | 10,314 | 17 | 49,452 | 83 |
| Alaska | 162 | 162 | 100 | 9 | 6 | 153 | 94 |
| Hawaii | 625 | 625 | 100 | 35 | 6 | 590 | 94 |
| U.S. total | 60,553 | 59,553 | 98 | 10,358 | 17 | 50,195 | 83 |

[1] Of total other land.

TABLE 53.—*Dominant conservation problems on "other land" and land needing treatment*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | Land having any problem | Having dominant problem of— | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Erosion hazard | | | Excess water | | | Unfavorable soil | | | Adverse climate | | |
| | | Total | Needing treatment | | Total | Needing treatment | | Total | Needing treatment | | Total | Needing treatment | |
| | *1,000 acres* | *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *1,000 acres* | *Per-cent* | *1,000 acres* | *acres 1,000* | *Per-cent* |
| Northeast | 6,920 | 3,181 | 645 | 20 | 2,434 | 308 | 13 | 1,294 | 180 | 14 | 10 | 4 | 40 |
| Lake States | 8,629 | 1,244 | 166 | 13 | 5,342 | 652 | 12 | 2,043 | 540 | 26 | 0 | — | — |
| Corn Belt | 7,511 | 4,743 | 1,057 | 22 | 2,180 | 373 | 17 | 589 | 129 | 22 | 0 | — | — |
| Northern Plains | 2,323 | 1,408 | 334 | 24 | 330 | 40 | 12 | 356 | 51 | 14 | 230 | 33 | 14 |
| Appalachian | 4,947 | 3,135 | 887 | 28 | 1,092 | 197 | 18 | 720 | 235 | 33 | 0 | — | — |
| Southeast | 5,047 | 1,288 | 483 | 37 | 2,684 | 369 | 14 | 1,074 | 266 | 25 | 0 | — | — |
| Delta States | 4,121 | 762 | 247 | 32 | 642 | 180 | 28 | 2,717 | 709 | 26 | 0 | — | — |
| Southern Plains | 2,663 | 1,604 | 493 | 31 | 304 | 121 | 40 | 579 | 398 | 69 | 177 | 21 | 12 |
| Mountain | 8,850 | 2,575 | 253 | 10 | 245 | 40 | 16 | 4,527 | 268 | 6 | 1,503 | 35 | 2 |
| Pacific | 7,581 | 2,939 | 234 | 8 | 344 | 117 | 34 | 2,540 | 239 | 9 | 1,759 | 19 | 1 |
| U.S. mainland | 58,594 | 22,879 | 4,799 | 21 | 15,597 | 2,397 | 15 | 16,439 | 3,015 | 18 | 3,679 | 103 | 3 |
| Alaska | 162 | 11 | 3 | 27 | 125 | (1) | — | 21 | 6 | 29 | 5 | 0 | — |
| Hawaii | 625 | 67 | 35 | 52 | 3 | 0 | — | 465 | 0 | 0 | 90 | (1) | — |
| U.S. total | 59,381 | 22,957 | 4,837 | 21 | 15,725 | 2,397 | 15 | 16,925 | 3,021 | 18 | 3,774 | 103 | 3 |

[1] Less than 500 acres.

land" will increase as rural living increases, living standards improve, need for recreation steps up, and interest in wildlife grows. These developments will be most significant in the more heavily populated regions, especially in the area east of the Great Plains and west of the Rocky Mountains.

The proportion of other land needing treatment varies. It is less than 10 percent in the western regions, where much of this kind of land is not feasible to treat; more than 20 percent in more humid regions where more of it can be treated economically; and (table 52) 38 percent in the Southern Plains, possibly because in that region a higher proportion is being set aside for wildlife land, which needs conservation treatment.

## MAJOR CONSERVATION PROBLEMS

### Erosion

Erosion is the dominant problem on 23.0 (22.9) million acres of other land. Of this amount, only 4.8 million acres or 21 percent needs treatment and is feasible to treat. The acreage of "other land" with an erosion problem ranges from less than 1 million acres in the Delta States to nearly 5 million in the Corn Belt; that needing treatment from less than 200,000 acres in the Lake States to more than 1.1 million acres in the Corn Belt. More than 30 percent of this land needs treatment in the Southeast, Delta States, and Southern Plains regions.

### Excess water

About 15.7 (15.6) million acres of other land has a dominant problem of excess water, of which about 2.4 million acres or 15 percent needs conservation treatment. The acreage ranges from less than 250,000 acres in the Mountain States to more than 5.3 million acres in the Lake States. The acreage needing conservation treatment ranges from 40,000 acres in the Northern Plains and Mountain States to more than 600,000 acres in the Lake States; and the proportion from 12 percent in the Northern Plains to 40 percent in the Southern Plains regions.

### Unfavorable soil

About 16.9 (16.4) million acres of other land has unfavorable soil conditions as the dominant problem, of which about 3 million acres or 18 percent needs conservation treatment. The acreage ranges from less than 500,000 acres in the Northern Plains to more than 4 million acres in the Mountain States and the acreage needing treatment from about 50,000 acres in the Northern Plains to more than 700,000 acres in the Delta States.

### Adverse climate

Adverse climate is the dominant problem on 3.8 (3.7) million acres of "other land." Only about 100,000 acres of this, or 3 percent, needs conservation treatment (table 53). This problem affects more land in the West than elsewhere, with largest acreages in the Mountain and Pacific regions.

FG-118-127, MD-RC-2-69

*Figure 53.*—**New urban and built-up areas are expected to take up nearly 16 million acres of present agricultural land by 1975, as happened in the area pictured above. The aerial photo on the left, taken in 1937, shows the same area as that on the right, taken in 1957 in the suburbs of Washington, D.C.**

## *Nonagricultural Land*

The increasing needs of urban communities will cause much land to be converted from agricultural uses to urban and built-up areas in the immediate future (fig. 53). The Conservation Needs Inventory (CNI) indicates that 15.8 million acres of agricultural land will change to that use by 1975 (table 54). This would be a 31 percent increase in urban and built-up areas from 1958.

Almost half of the new urban and built-up land or nearly 7 million acres will come from cropland (fig. 54). The rest will come from:

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*Figure 54.*—**Nearly half the land going out of agriculture to urban and built-up areas will come from present cropland.**

N-40427

***Figure 55.*—Extensive buildings, parking lots, and paved streets waterproof most of the land surface in urban and built-up areas, greatly increasing runoff of rainfall.**

pasture and range, 3.2 million acres; forest and woodland, nearly 4.0 million acres; and other land, mainly idle, 1.7 million acres.

Urbanization will be concentrated in the regions already most heavily populated—Northeast, Lake States, Corn Belt, and Pacific—and the Southeast.

These newly urbanized areas will present some of the most difficult conservation problems. The proportion of rainfall running off the land and the drainage patterns will be much altered (fig. 55). Erosion problems will increase as a consequence of road and building construction and the unnatural concentration of runoff water.

In addition to vegetative and mechanical erosion control practices, many kinds of resource development will be needed. Parks and greenbelts, highway beautification, stream improvement, drainage, wildlife habitat, water

improvements, and woodland improvements will be among the most prevalent needs. Recreational areas will require specialized soil and water treatment. Virtually all urban land that is not covered by paving or buildings will require intensive treatment.

TABLE 54.—*Land going out of agriculture to urban and built-up areas, 1958 to 1975*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

| Region | Total new urban, 1975 | Going into urban and built-up areas from— | | | | Urban areas, 1958 | Total urban and built-up, 1975 [1] |
|---|---|---|---|---|---|---|---|
| | | Cropland | Pasture and range | Forest and woodland | Other land | | |
| | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* |
| Northeast | 2,312 | 912 | 214 | 790 | 397 | 7,014 | 9,326 |
| Lake States | 1,996 | 1,099 | 190 | 626 | 342 | 5,294 | 7,290 |
| Corn Belt | 3,190 | 2,017 | 409 | 501 | 264 | 9,052 | 12,242 |
| Northern Plains | 403 | 302 | 81 | 12 | 8 | 5,025 | 5,428 |
| Appalachian | 1,019 | 365 | 217 | 335 | 103 | 3,928 | 4,947 |
| Southeast | 2,061 | 363 | 428 | 950 | 321 | 3,727 | 5,788 |
| Delta States | 629 | 182 | 111 | 300 | 36 | 2,897 | 3,526 |
| Southern Plains | 938 | 382 | 346 | 174 | 36 | 5,777 | 6,715 |
| Mountain | 1,238 | 425 | 606 | 102 | 105 | 4,003 | 5,241 |
| Pacific | 2,243 | 985 | 627 | 460 | 172 | 3,943 | 6,186 |
| U.S. mainland | 15,821 | 6,968 | 3,173 | 3,977 | 1,702 | 50,660 | 66,481 |
| Alaska | 0 | 0 | 0 | 0 | 0 | 44 | 44 |
| Hawaii | 22 | 8 | 6 | 8 | 1 | 62 | 84 |
| U.S. total | 15,843 | 6,976 | 3,179 | 3,985 | 1,704 | 50,766 | 66,609 |

[1] Sum of column 1 and column 6.

# Part III. Watersheds

## *Watershed Project Needs*

Foregoing sections of this report deal with conservation needs that can be met by private landowners independently or with technical or financial assistance from local, State, or Federal agencies. This section deals with those needs that can be met most feasibly through the cooperative action of local organizations, States, and Federal agencies working together in the Nation's small upstream watersheds.

The objectives of the watershed phase of the Conservation Needs Inventory (CNI) were: (1) To identify the small watersheds in which the nature and extent of resource conservation and development problems require project-type action of the kind authorized by the Watershed Protection and Flood Prevention Act (Public Law 566) or similar legislation, and (2) to identify specific project needs within these watersheds.

### MAJOR PROBLEMS AND CURRENT PROGRAMS

For the Inventory, resource conservation and development problems in small watersheds were classified as follows: (1) Floodwater damage, including inundation or sediment damage on flood plains; (2) critical erosion requiring project-type action for its control; (3) agricultural water management problems—typified by drainage and irrigation; and (4) other rural water management problems, including stockwater, municipal-industrial water supply, fish-wildlife and recreational development.

The U.S. Department of Agriculture (USDA) has been active in programs for solving such land and water problems for more than 50 years. The Weeks Forest Purchase Act of 1911, for example, authorized Federal acquisition of forested areas for runoff control. The Flood Control Acts of 1936 and 1944, and the "pilot" watershed program of 1953, provided the first demonstration of the benefits of watershed projects.

The current authority for local-State-Federal participation in upstream watershed projects is the Watershed Protection and Flood Prevention Act (Public Law 566). As passed in 1954 and several times amended, Public Law 566 makes it possible for soil conservation districts, watershed districts, counties, municipalities or other local organizations or the States to obtain Federal technical and financial assistance for small-watershed projects for flood-prevention and related water-management purposes. As of September 1, 1964, the Secretary of Agriculture had received applications for assistance covering 2,171 small watersheds in the United States (5 are from Hawaii, none from Alaska). The applications covering 2,166 small watersheds in the 48 mainland States involve 155.0 million acres or roughly 8 percent of the area. The Secretary has authorized planning assistance for 1,009 projects covering 68.8 million acres and operations for 582 watersheds covering 33.0 million acres.

The Inventory is intended to furnish correct information on the ultimate scope and character of group projects needed for resolving upstream resource conservation and development problems. Other uses of the data are discussed briefly following the Inventory findings.

### WATERSHED INVENTORY CONCEPTS AND PROCEDURE

The watershed phase of the National Inventory of Soil and Water Conservation Needs (CNI) was completed during 1958-61 for the 48 mainland States, Hawaii, Puerto Rico, and the Virgin Islands. From base maps showing stream systems, each State or other inventory area was subdivided into from 3 (Virgin Islands) to 1,200 (California) watersheds of less than 250,000 acres in total area, the statutory size limit of watersheds planned under Public Law 566 (fig. 56). To simplify the Inventory, watersheds were delineated as close to (but within) the 250,000-acre limitation as natural hydrologic boundaries would allow. Exceptions to this practice were that (1) watersheds for which applications had been received under Public Law 566 were delineated as shown in the applications, and (2) to meet local needs, many watersheds were subdivided into two or more project units, as in California, Connecticut, Hawaii, Illinois, Kentucky, and Missouri.

A total of 12,781 watersheds were delineated in the United States (12,711 in the 48 mainland States). Some parts of Maine, Oklahoma, Oregon, and Texas were not mapped in detail

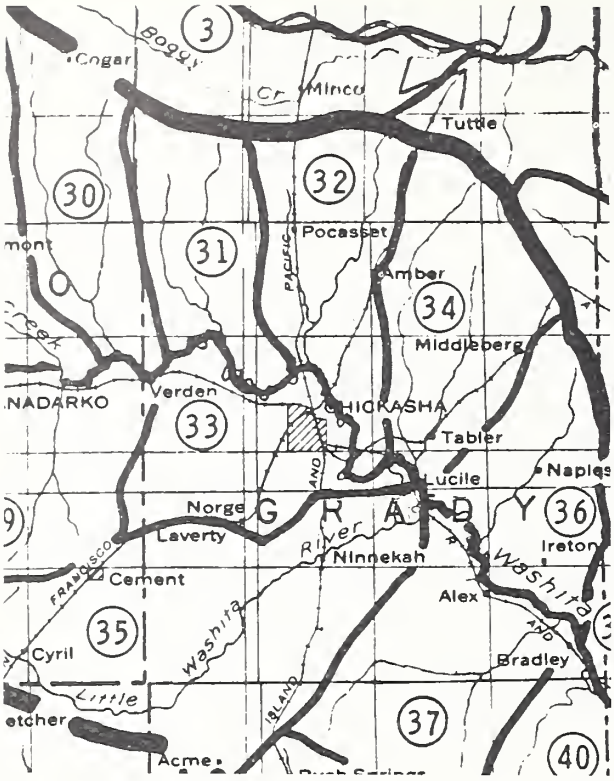


*Figure 56.*—**Portion of the stream-system map of Oklahoma showing watersheds as delineated for the watershed project needs inventory.**

because of the absence of watershed problems or infeasibility of project action. No watershed inventory was made in Alaska. Data on 21 additional watersheds in Puerto Rico and the Virgin Islands are published in *Basic Statistics of the National Inventory of Soil and Water Conservation Needs* (USDA–CNI 1962) but are not included in this report. The average size of the watersheds thus delineated is about 150,000 acres, compared to 72,000 acres for those on which USDA has received applications for projects under Public Law 566.

For each delineated watershed, estimates were made of the total acreage of flood plain, acreage with critical erosion as primary source areas of floodwater and sediment damage, the acreage drained or needing drainage with group outlet facilities, and the acreage potentially irrigable on the basis of suitable soils and available water. These problem acreages constituted limits within which needs for project action were determined. That is, estimates of needs for project action were limited to the parts of problem acreages that could not be feasibly protected, treated, or developed by individuals or groups without the assistance of organized soil conservation districts, watershed districts, drainage or irrigation districts, counties or other local and State units of government authorized to sponsor watershed projects under Public Law 566. It does not follow, however, that project action would necessarily be taken under Public Law 566.

Additional criteria for determining needed assistance were that related project measures would entail group action for installation and group benefits for justification and would not be clearly unjustified from an economic standpoint. Estimates were made of the acreages needing project action and the number of farms that would benefit or be otherwise affected by the project measures in each watershed. It should be clearly understood, however, that no detailed benefit-cost analyses were made as part of the Inventory. It is, therefore, not possible to state what proportion of the watersheds would show benefits in excess of costs of installing needed development or remedial measures.

Watershed inventory estimates were summarized at county and State levels by portions of 160 principal river basins. These data were then combined to give totals for 18 major drainage areas as delineated concurrently by the Soil Conservation Service for the *Atlas of River Basins of the United States* (SCS 1963) (fig. 57). The data were also summarized for the parts of each of these drainage areas in each State, and for the States and farm production regions as with other Conservation Needs Inventory data. Watersheds crossing State lines generally were assigned to a single State for reporting.

The major drainage areas (rather than the farm production regions) are used as the basis for regional analysis of this watershed part of this report. The basic soil data obtained from sample areas also are being coded on data processing cards so that they can be totaled for the major drainage areas or for any river basin more than 750 square miles in area as delineated in the *Atlas of River Basins*. These data are available for local use in river basin surveys and for other purposes involving watershed planning.

*Basic Statistics of the National Inventory of Soil and Water Conservation Needs* (USDA–CNI 1962) contains parallel summaries for the special water resource regions used by the U.S. Senate Select Committee on National Water Resources in its appraisals of national and regional water resources development needs (U.S. Sen. 1961).

## *Watershed Project Needs*

A total of 8,358 (8,323) or 65 percent of the watersheds delineated were found to need project action for one or more of the specific flood-prevention or water-management purposes (table 55). Watersheds needing some form of project action add up to a little over 50


*Figure 57.*

percent of the total area of the United States, excluding Alaska. An accurate estimate of the number of multipurpose projects could be determined only from an exhaustive study of State Inventory reports. The number would likely exceed 75 percent of the watersheds needing action.

Interest in a small-watershed approach to resource conservation and development is apparent in all sections of the country, particularly in the Tennessee Valley, the Gulf-South Atlantic region, the Central Valley, the Lower Mississippi Valley, and the Ohio Basin. In these five regions the total area of watersheds needing project action exceeds 75 percent of the total reported land and water area (table 55). By contrast, only 20 percent of the area of the Great Basin needs watershed projects. In all other mainland drainages, the area needing projects exceeds 20 percent of the gross area.

**Floodwater and sediment damage reduction**

About 7 percent or 125.8 (125.7) million acres of the Inventory area is flood plain (table 56), ranging from 1 percent or less in New England and Hawaii to 43 percent in the Lower Mississippi Valley (and to 86 percent in the Atchafalaya portion of the Lower Mississippi Valley). Other areas where flood-plain concentrations per unit area exceed the national average include the Gulf and South Atlantic, 15 percent; the Arkansas-White-Red, 11 percent; the Central Valley, 9 percent; and the Upper Mississippi, 8 percent.

Flood prevention requires combined private and public attention (fig. 58). Federal responsibilities for effective flood-prevention programs are well established by statute and are shared by the Army Corps of Engineers, the Department of Agriculture, and the Bureau of Reclamation, and in its area by the Tennessee Valley Authority.

The Corps of Engineers estimates that its existing, authorized, or feasible projects would provide at least some protection for about 74.6 million acres of urban and rural flood plain, of which 51.5 million acres is in watersheds of 250,000 acres or less. Of this 74.6 million acres about 49.9 million is afforded some protection in existing Corps of Engineers projects, including 48.9 million acres in rural areas (U.S. Sen. 1960).

The Inventory indicates that about half the total flood-plain area or 62.6 million acres needs protection from floodwater damages (fig. 59) and sedimentation (fig. 60). A total of 6,364 (6,343) watersheds (table 56) need upstream projects for flood prevention to reduce these damages. This can be regarded as a minimum,

TABLE 55.—*Watershed projects needed for all purposes, 1958*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

BY MAJOR DRAINAGE AREAS

| Area or region | Land and water area [1] | Delineated watersheds | Watersheds needing projects | |
|---|---|---|---|---|
| | | | Number | Area |
| | *1,000 acres* | *Number* | *Number* | *1,000 acres* |
| New England | 47,987 | 386 | 169 | 18,982 |
| Middle Atlantic | 64,723 | 640 | 417 | 44,743 |
| Gulf and South Atlantic | 161,323 | 1,208 | 1,047 | 138,713 |
| Tennessee Valley | 25,771 | 191 | 175 | 24,324 |
| Ohio Basin | 104,761 | 1,145 | 831 | 77,904 |
| Great Lakes—St. Lawrence | 82,451 | 575 | 264 | 38,909 |
| Upper Mississippi | 119,545 | 911 | 670 | 83,250 |
| Lower Mississippi | 39,512 | 370 | 321 | 30,865 |
| Eastern mainland | 646,073 | 5,426 | 3,894 | 457,690 |
| Arkansas–White–Red | 169,450 | 994 | 688 | 101,149 |
| Souris–Red | 37,500 | 260 | 96 | 16,756 |
| Rio Grande and Gulf | 214,164 | 881 | 551 | 78,559 |
| Missouri Basin | 326,140 | 2,093 | 1,149 | 164,105 |
| Columbia Basin | 139,030 | 679 | 381 | 47,398 |
| North Pacific | 23,059 | 241 | 104 | 10,040 |
| Great Basin | 121,248 | 395 | 215 | 24,043 |
| Central Valley | 41,330 | 706 | 670 | 34,578 |
| Colorado Basin | 173,684 | 717 | 311 | 47,281 |
| Central and South Pacific | 30,914 | 319 | 264 | 19,120 |
| Western mainland | 1,276,519 | 7,285 | 4,429 | 543,029 |
| U.S. mainland | 1,922,592 | 12,711 | 8,323 | 1,000,719 |
| Hawaii | 4,025 | 70 | 35 | 1,611 |
| U.S. total [2] | 1,926,617 | 12,781 | 8,358 | 1,002,330 |

BY FARM PRODUCTION REGIONS

| | | | | |
|---|---|---|---|---|
| Northeast | 114,444 | 999 | 419 | 47,663 |
| Lake States | 126,929 | 800 | 426 | 69,647 |
| Corn Belt | 167,651 | 1,473 | 1,068 | 111,164 |
| Northern Plains | 195,298 | 1,206 | 599 | 93,247 |
| Appalachian | 125,230 | 1,214 | 1,107 | 118,481 |
| Southeast | 128,174 | 999 | 836 | 108,810 |
| Delta States | 92,491 | 732 | 558 | 65,873 |
| Southern Plains | 215,583 | 822 | 723 | 103,060 |
| Mountain | 551,837 | 2,586 | 1,238 | 184,049 |
| Pacific | 204,955 | 1,880 | 1,349 | 98,725 |
| U.S. mainland | 1,922,592 | 12,711 | 8,323 | 1,000,719 |
| Hawaii | 4,025 | 70 | 35 | 1,611 |
| U.S. total [1] | 1,926,617 | 12,781 | 8,358 | 1,002,330 |

[1] As reported in this inventory.

[2] Watershed project needs not inventoried in Alaska.

despite probable duplication of some flood-plain acreages included in Corps of Engineer projects. Most flood-prevention projects require a combination of conservation measures on watershed uplands (fig. 61) with floodwater-retarding dams (fig. 62) and other water-control structures on tributary streams.

The flood plain needing project action is distributed about equally between eastern and western drainages. About 950,000 farms or nearly 25 percent of the 3.7 million farms in the United States would benefit from flood-prevention projects.

The major drainage areas where upstream protection needs are most pressing are the Central Valley, Hawaii, the Tennessee and Ohio Basins, all Pacific Coast areas, and the Arkansas-White-Red Basin.

**Critical erosion reduction**

Much of the erosion damage from surface runoff results from intense rainfall, imperme-

TABLE 56.—*Watershed projects needed for flood prevention, 1958*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

BY MAJOR DRAINAGE AREAS

| Area or region | Total flood plain area | Flood plain needing protection | Watersheds needing projects | Farms benefiting |
|---|---|---|---|---|
| | *1,000 acres* | *1,000 acres* | *Number* | *Number* |
| New England | 442 | 180 | 145 | 6,207 |
| Middle Atlantic | 3,438 | 1,538 | 372 | 50,573 |
| Gulf and South Atlantic | 24,031 | 13,892 | 1,007 | 225,198 |
| Tennessee Valley | 1,696 | 1,204 | 174 | 52,228 |
| Ohio Basin | 6,553 | 4,138 | 604 | 138,026 |
| Great Lakes—St. Lawrence | 2,014 | 755 | 218 | 21,092 |
| Upper Mississippi | 9,764 | 3,389 | 474 | 68,094 |
| Lower Mississippi | 16,924 | 6,970 | 277 | 78,549 |
| Eastern mainland | 64,862 | 32,066 | 3,271 | 639,967 |
| Arkansas–White–Red | 18,192 | 9,943 | 645 | 104,736 |
| Souris–Red | 2,496 | 1,264 | 93 | 9,834 |
| Rio Grande and Gulf | 8,194 | 3,693 | 473 | 43,293 |
| Missouri Basin | 15,941 | 6,701 | 862 | 74,632 |
| Columbia Basin | 2,636 | 1,214 | 320 | 15,641 |
| North Pacific | 586 | 314 | 99 | 8,497 |
| Great Basin | 3,340 | 1,596 | 153 | 12,047 |
| Central Valley | 3,668 | 3,003 | 144 | 18,423 |
| Colorado Basin | 3,921 | 1,614 | 196 | 12,693 |
| Central and South Pacific | 1,905 | 1,172 | 87 | 9,897 |
| Western mainland | 60,879 | 30,514 | 3,072 | 309,693 |
| U.S. mainland | 125,741 | 62,580 | 6,343 | 949,660 |
| Hawaii | 13 | 11 | 21 | 470 |
| U.S. total | 125,754 | 62,591 | 6,364 | 950,130 |

BY FARM PRODUCTION REGIONS

| | | | | |
|---|---|---|---|---|
| Northeast | 3,100 | 838 | 372 | 24,986 |
| Lake States | 6,092 | 2,220 | 374 | 50,638 |
| Corn Belt | 19,026 | 6,838 | 699 | 119,665 |
| Northern Plains | 7,492 | 5,048 | 544 | 70,858 |
| Appalachian | 8,529 | 6,082 | 877 | 261,596 |
| Southeast | 21,070 | 11,770 | 801 | 144,597 |
| Delta States | 29,148 | 12,299 | 544 | 108,682 |
| Southern Plains | 8,391 | 5,779 | 657 | 77,463 |
| Mountain | 13,049 | 5,044 | 893 | 37,126 |
| Pacific | 9,844 | 6,662 | 582 | 54,049 |
| U.S. mainland | 125,741 | 62,580 | 6,343 | 949,660 |
| Hawaii | 13 | 11 | 21 | 470 |
| U.S. total | 125,754 | 62,591 | 6,364 | 950,130 |

able soils, poor vegetative cover, steep slopes, and other limitations to infiltration on uplands rather than on flood plains. This damage is evidenced by rapid gullying (fig. 63), streambank caving in tributaries, and other forms of extreme erosion which in many parts of the country have advanced beyond the point where individuals can be expected to provide effective control.

About 75.7 (75.5) million acres in the United States has a critical erosion hazard (table 57). About a third of this or 23.5 (23.4) million acres needs project action for effective treatment. A total of 4,661 (4,651) watersheds need projects for critical-erosion control, which would benefit nearly 505 thousand farms. While the basic problem is most extensive in the Western drainages, some of the regional variations may be due to differences between States in concepts used in reporting.

The overall needs for project action are greater in Eastern than in Western drainage areas. In the East, the 3.6 million acres needing project action in 2,357 watershed projects amounts to 40 percent of the 8.9 million acres with critical erosion areas considered for group treatment; in the West, the 19.8 million acres needing treatment in 2,294 watersheds cover

IA-2594

*Figure 58.*—The individual farmer often is helpless in protecting his land against floods. Joint public and private action through organized community projects is necessary.

MINN-1768

*Figure 59.*—About half the flood plain land in the United States is subject to flood damages to farm property, livestock, roads, public facilities, and urban developments and needs community projects for protection.

only 30 percent of the 66.6 million acres with critical erosion.

Drainage areas which need watershed-project action on more than 50 percent of the total acreage with critical erosion include Hawaii, non-Delta portions of the Lower Mississippi Valley, the Gulf and South Atlantic, and the Great Basin. Needs are as acute in the loessial areas of the Upper Mississippi and Lower Missouri Basins, though the summarized estimates obscure these and other local conditions.

**Water management through drainage**

Drainage ranks second to flood-plain protection as a purpose of potential watershed projects. Of the 8,358 (8,323) watersheds needing projects, 3,937 (3,931) need drainage as one of the purposes (table 58). Such projects would provide drainage for 45.5 million acres and benefit more than 549,000 farms.

Basic soil data and other information obtained in the CNI indicate that about 172.5 million acres of level or nearly level land in the United States needs (and may or may not have) group drainage outlets if it is to be used efficiently for agricultural purposes. The Census of Agriculture and other sources (U.S. Census

KY-657

*Figure 60.*—Watershed treatment projects are needed to prevent sediment damage to valley fields and other flood plain land subject to floods.

MINN-1731

***Figure 61.*—Contour farming, terracing, stripcropping, and other soil and water conservation measures retard runoff and reduce erosion on the uplands above water-retarding structures in watershed projects.**

1962, Wooten 1962) indicate that about 155 million acres of agricultural land is now drained and 92.3 million acres is in organized drainage districts that benefit 500 acres or more of nonirrigated land. Some of the drainage, however, is inadequate because of ineffective outlets.

Nearly 70 percent of the agricultural drainage reported by the Census is in the Mississippi Valley, Ohio Basin, and Great Lakes drainage areas. Most of the remainder is in the Central Valley in California, the Gulf Coast in Texas, lower Florida, and Delaware.

Accurate regional estimates of additional acreage drained with group outlets but not within organized projects (as such) are not available.

The Inventory indicates that 172.5 million acres could be improved with group drainage facilities.

The Economic Research Service estimates that 91.8 million acres of the drainage problem area identified in the Inventory still needs improved drainage (table 58). The Inventory shows that 45.5 million acres in 3,937 (3,931) watersheds needs project action for the installation of drainage facilities not feasible to individual landowners. Thus watershed project action might account for about 50 percent of the area that needs improvement drainage.

Almost two-thirds of the land that would be feasible to drain in watershed projects is in the eastern third of the United States; the Gulf-South Atlantic area alone totals more than 14 million acres. In the Arkansas-White-Red, Rio Grande-Gulf, and Central Valley drainage areas also have extensive problem areas. Regardless of acreages involved, group drainage may be expected to depend strongly on watershed projects in the Mississippi and Ohio Basins in the


TEX–49662

*Figure 62.*—**Earthen dams on upstream tributaries hold back runoff water until it can be released gradually without flooding valley bottom land. In this picture, the square object in the water is the top of the drawdown tube that carries water under the dam.**

East; and in the Souris-Red, Rio Grande-Gulf, Great Basin, and most of California.

It should be clearly understood that the estimates of needs for drainage are based on the physical potentials for increased agricultural production from wet land. This does not imply that such land may not have a higher value for fish and wildlife or for recreational purposes if left in its existing state. Nor does it imply that the increased net returns from drainage would justify the cost.

MISS–D41–1

*Figure 63.*—**Rapid gullying of uplands produces sediment that fills reservoirs and damages flood plains. Public assistance is needed for immediate treatment of critical areas to protect water-control structures.**

**Water management for irrigation**

The Inventory is the first nationwide appraisal of irrigation potentials based on the limiting factors of the soil suitability of and availability of water within numerous watersheds as hydrologic planning units. Results indicate that 66.9 (66.8) million acres of cropland and pasture could be irrigated (table 59). Attainment of this potential would slightly more than double the 33.2 million acres estimated by the Bureau of the Census to have been irrigated in 1959 (U.S. Census 1962). Project action is needed to provide adequate water for 14.7 million acres of the remaining irrigable area. Of the watersheds delineated in the Inventory 2,625 (2,611) need projects for irrigation development, which would benefit about 219,000 farms.

About 64 percent of the potential national increase of 33.7 million acres could occur in Western drainages, which now account for 93 percent of all mainland irrigation. Major drainage areas that have the greatest prospect for irrigation expansion include, in decreasing order, the Rio Grande-Gulf, Missouri, Gulf-South Atlantic, Arkansas-White-Red, Columbia, and Lower Mississippi. Sharp increases

TABLE 57.—*Watershed projects needed for critical erosion damage reduction, 1958*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

BY MAJOR DRAINAGE AREAS

| Area or region | Critical erosion areas | Areas needing projects | Watersheds needing projects | Farms benefiting |
|---|---|---|---|---|
| | *1,000 acres* | *1,000 acres* | *Number* | *Number* |
| New England | 784 | 27 | 99 | 3,427 |
| Middle Atlantic | 200 | 68 | 277 | 27,964 |
| Gulf and South Atlantic | 1,897 | 1,063 | 776 | 160,580 |
| Tennessee Valley | 671 | 298 | 157 | 32,855 |
| Ohio Basin | 1,305 | 440 | 437 | 57,944 |
| Great Lakes—St. Lawrence | 679 | 45 | 113 | 5,463 |
| Upper Mississippi | 1,832 | 680 | 308 | 32,107 |
| Lower Mississippi | 1,555 | 998 | 190 | 38,995 |
| Eastern mainland | 8,923 | 3,619 | 2,357 | 359,605 |
| Arkansas–White–Red | 3,807 | 810 | 439 | 23,212 |
| Souris–Red | 40 | 13 | 40 | 1,026 |
| Rio Grande and Gulf | 3,974 | 1,004 | 228 | 15,199 |
| Missouri Basin | 14,135 | 4,196 | 615 | 59,936 |
| Columbia Basin | 10,505 | 1,045 | 309 | 8,757 |
| North Pacific | 1,017 | 213 | 87 | 5,647 |
| Great Basin | 6,667 | 3,405 | 153 | 3,636 |
| Central Valley | 6,507 | 3,198 | 98 | 3,778 |
| Colorado Basin | 13,709 | 2,758 | 242 | 13,232 |
| Central and South Pacific | 6,234 | 3,143 | 83 | 11,104 |
| Western mainland | 66,595 | 19,785 | 2,294 | 145,527 |
| U.S. mainland | 75,518 | 23,404 | 4,651 | 504,862 |
| Hawaii | 152 | 97 | 10 | 30 |
| U.S. total | 75,670 | 23,501 | 4,661 | 504,892 |

BY FARM PRODUCTION REGIONS

| | | | | |
|---|---|---|---|---|
| Northeast | 999 | 42 | 222 | 9,580 |
| Lake States | 688 | 155 | 204 | 9,705 |
| Corn Belt | 4,593 | 1,562 | 450 | 67,219 |
| Northern Plains | 2,889 | 1,373 | 207 | 15,057 |
| Appalachian | 2,310 | 1,112 | 813 | 183,023 |
| Southeast | 1,182 | 668 | 582 | 93,512 |
| Delta States | 1,680 | 1,032 | 372 | 41,581 |
| Southern Plains | 4,503 | 1,282 | 452 | 28,167 |
| Mountain | 36,972 | 8,092 | 844 | 24,783 |
| Pacific | 19,702 | 8,086 | 505 | 32,235 |
| U.S. mainland | 75,518 | 23,404 | 4,651 | 504,862 |
| Hawaii | 152 | 97 | 10 | 30 |
| U.S. total | 75,670 | 23,501 | 4,661 | 504,892 |

are indicated for the Lower Mississippi, Gulf-South Atlantic, and Arkansas-White-Red drainages.

Inventory data for acreages needing project action can be interpreted more realistically in terms of adequate water for all irrigable land than in terms of water for land not currently irrigated. For example, the Bureau of Reclamation estimated that additional water could be utilized on from 40 to 45 percent of the land now irrigated in Western drainages (U.S. Sen. 1960a). Need for additional water is most pressing in the Missouri Basin, the Great Basin, and the Colorado Basin. Based on these estimates and Census data, the Economic Research Service estimated that only about 20.9 (20.8) million acres is fully irrigated. About 19.5 million acres of this is in western drainage areas. Coupling this information with Inventory findings indicates about 46 million acres of agricultural land could use either new irrigation or improvement of existing irrigation. Of this, 33.8 million acres is in the western drainages. Leading major drainage areas include the Missouri, Rio Grande-Gulf, Columbia, Arkansas-White-Red, Gulf-South Atlantic, Central Valley, and Lower Mississippi.

A total of 14.7 million acres in 2,625 (2,611)

TABLE 58.—*Watershed projects needed for farm drainage, 1958*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

BY MAJOR DRAINAGE AREAS

| Area or region | Drainage problem area [1] | Area drained [2] | Remaining drainage [3] problem area | Area needing projects | Watersheds needing projects | Farms benefiting |
|---|---|---|---|---|---|---|
| | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *Number* | *Number* |
| New England | 3,155 | 0 | 3,155 | 106 | 95 | 3,308 |
| Middle Atlantic | 8,844 | 895 | 7,949 | 2,570 | 250 | 39,622 |
| Gulf and South Atlantic | 43,173 | 7,710 | 35,463 | 14,031 | 826 | 134,893 |
| Tennessee Valley | 989 | 59 | 930 | 312 | 138 | 15,386 |
| Ohio Basin | 15,603 | 10,849 | 4,754 | 4,059 | 450 | 98,545 |
| Great Lakes—St. Lawrence | 23,544 | 19,267 | 4,277 | 1,686 | 192 | 26,805 |
| Upper Mississippi | 17,104 | 16,824 | 3,787 | 3,787 | 363 | 59,179 |
| Lower Mississippi | 16,575 | 15,547 | 3,536 | 3,536 | 253 | 46,073 |
| Eastern mainland | 128,987 | 71,151 | 63,851 | 30,087 | 2,567 | 423,811 |
| Arkansas–White–Red | 14,616 | 1,611 | 13,005 | 5,306 | 364 | 40,883 |
| Souris–Red | 5,628 | 5,742 | 1,149 | 1,149 | 52 | 8,242 |
| Rio Grande and Gulf | 7,631 | 6,251 | 3,808 | 3,808 | 132 | 16,795 |
| Missouri Basin | 8,256 | 3,869 | 4,387 | 1,028 | 261 | 15,635 |
| Columbia Basin | 1,414 | 443 | 971 | 757 | 207 | 15,597 |
| North Pacific | 614 | 246 | 368 | 214 | 60 | 4,849 |
| Great Basin | 812 | 192 | 620 | 617 | 86 | 4,984 |
| Central Valley | 2,701 | 2,272 | 2,147 | 2,147 | 101 | 13,285 |
| Colorado Basin | 1,410 | 122 | 1,288 | 201 | 64 | 3,435 |
| Central and South Pacific | 399 | 398 | 223 | 223 | 37 | 1,683 |
| Western mainland | 43,481 | 21,146 | 27,966 | 15,450 | 1,364 | 125,383 |
| U.S. mainland | 172,468 | 92,297 | 91,817 | 45,537 | 3,931 | 549,199 |
| Hawaii | 4 | — | 4 | 2 | 6 | 41 |
| U.S. total | 172,472 | 92,297 | 91,821 | 45,539 | 3,937 | 549,240 |
| BY FARM PRODUCTION REGIONS | | | | | | |
| Northeast | 12,652 | 752 | 11,473 | 1,225 | 227 | 17,802 |
| Lake States | 28,892 | 21,021 | 7,594 | 3,726 | 309 | 53,656 |
| Corn Belt | 30,394 | 35,394 | 6,846 | 6,846 | 568 | 121,516 |
| Northern Plains | 5,664 | 3,412 | 2,171 | 684 | 126 | 7,300 |
| Appalachian | 14,350 | 2,893 | 11,046 | 5,596 | 648 | 130,492 |
| Southeast | 34,116 | 5,353 | 27,734 | 10,920 | 635 | 82,877 |
| Delta States | 32,062 | 14,832 | 16,612 | 8,997 | 465 | 69,201 |
| Southern Plains | 5,872 | 5,825 | 2,862 | 2,862 | 273 | 19,035 |
| Mountain | 2,572 | 390 | 2,103 | 1,305 | 313 | 13,117 |
| Pacific | 5,894 | 2,423 | 3,376 | 3,376 | 367 | 34,203 |
| U.S. mainland | 172,468 | 92,297 | 91,817 | 45,537 | 3,931 | 549,199 |
| Hawaii | 4 | — | 4 | 2 | 6 | 41 |
| U.S. total | 172,472 | 92,297 | 91,821 | 45,539 | 3,937 | 549,240 |

[1] Includes area now drained.

[2] In organized drainage districts, 1959 (U.S. Census 1961).

[3] Column 1 minus column 2, or same as column 4, whichever is greater.

watersheds need project action to be irrigated adequately. This amounts to 32 percent of the remaining potentially irrigable land in the United States. More than 11 million acres needing project-type irrigation in 1,482 watersheds account for 33 percent of the remaining irrigable area in the western mainland and 3.6 million acres in 1,129 watersheds for 29 percent in the East.

The foregoing estimates do not imply that the needed water rights are well enough established under prevailing State doctrines, statutes, or adjudications, to allow full development of all the acreage indicated. The estimates primarily consider suitability of soil and physical availability of water suitable for efficient irrigation.

**Comparative importance of major purposes**

Floodwater and sediment-damage reduction on the flood plains considerably outweigh all other small-watershed project purposes for the nation and for 8 of the 18 major drainage areas of the 48 mainland States; it ranks second in

TABLE 59.—*Watershed projects needed for irrigation development, 1958*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

BY MAJOR DRAINAGE AREAS

| Area or region | Irrigable area [1] | Area fully irrigated [2] | Remaining irrigable area [3] | Area needing projects | Watersheds needing projects | Farms benefiting |
|---|---|---|---|---|---|---|
| | *1,000 acres* | *1,000 acres* | *1,000 acres* | *1,000 acres* | *Number* | *Number* |
| New England | 210 | 68 | 143 | 56 | 45 | 1,290 |
| Middle Atlantic | 1,184 | 125 | 1,059 | 216 | 119 | 7,671 |
| Gulf and South Atlantic | 4,922 | 557 | 4,365 | 2,033 | 500 | 67,189 |
| Tennessee Valley | 234 | 13 | 221 | 70 | 85 | 5,372 |
| Ohio Basin | 1,049 | 19 | 1,030 | 320 | 177 | 15,423 |
| Great Lakes—St. Lawrence | 811 | 71 | 740 | 149 | 48 | 5,472 |
| Upper Mississippi | 1,182 | 57 | 1,125 | 173 | 15 | 2,012 |
| Lower Mississippi | 3,924 | 397 | 3,527 | 556 | 140 | 18,767 |
| Eastern mainland | 13.517 | 1,307 | 12,210 | 3,573 | 1,129 | 123,196 |
| Arkansas–White–Red | 6,844 | 2,255 | 4,589 | 905 | 212 | 10,884 |
| Souris–Red | 10 | 6 | 4 | 0 | 0 | 0 |
| Rio Grande and Gulf | 11,106 | 4,606 | 6,500 | 150 | 47 | 2,351 |
| Missouri Basin | 10,477 | 2,398 | 8,079 | 2,736 | 367 | 11,843 |
| Columbia Basin | 8,295 | 2,833 | 5,462 | 1,728 | 256 | 15,569 |
| North Pacific | 337 | 196 | 141 | 128 | 50 | 6,244 |
| Great Basin | 2,667 | 897 | 1,770 | 1,227 | 156 | 10,240 |
| Central Valley | 7,571 | 3,821 | 3,750 | 2,425 | 129 | 19,680 |
| Colorado Basin | 4,907 | 2,075 | 2,832 | 1,286 | 212 | 8,755 |
| Central and South Pacific | 1,070 | 387 | 683 | 500 | 53 | 10,036 |
| Western mainland | 53,284 | 19,472 | 33,810 | 11,084 | 1,482 | 95,602 |
| U.S. mainland | 66,801 | 20,779 | 46,020 | 14,658 | 2,611 | 218,798 |
| Hawaii | 128 | 141 | 13 | 29 | 14 | 701 |
| U.S. total | 66,929 | 20,920 | 46,007 | 14,686 | 2,625 | 219,499 |

BY FARM PRODUCTION REGIONS

| | | | | | | |
|---|---|---|---|---|---|---|
| Northeast | 1,112 | 206 | 906 | 291 | 113 | 8,899 |
| Lake States | 659 | 87 | 572 | 30 | 13 | 1,525 |
| Corn Belt | 4,288 | 87 | 4,201 | 583 | 98 | 19,895 |
| Northern Plains | 6,167 | 2,978 | 3,189 | 202 | 97 | 3,270 |
| Appalachian | 1,874 | 118 | 1,756 | 329 | 285 | 20,745 |
| Southeast | 4,008 | 490 | 3,518 | 1,963 | 463 | 57,631 |
| Delta States | 7,016 | 1,296 | 5,720 | 1,029 | 192 | 12,689 |
| Southern Plains | 10,612 | 5,162 | 5,450 | 343 | 156 | 5,973 |
| Mountain | 15,773 | 4,645 | 11,128 | 5,655 | 780 | 36,685 |
| Pacific | 15,292 | 5,712 | 9,580 | 4,233 | 414 | 51,486 |
| U.S. mainland | 66,801 | 20,781 | 46,020 | 14,658 | 2,611 | 218,798 |
| Hawaii | 128 | 141 | 29 | 29 | 14 | 701 |
| U.S. total | 66,929 | 20,922 | 46,049 | 14,686 | 2,625 | 219,499 |

[1] Includes area now irrigated.

[2] Calculated by Economic Research Service from census data on irrigated land in farms (Census 1962a) and Bureau of Reclamation estimates of acreage of irrigated land needing supplemental water (Bur. Reclam. 1960).

[3] Column 1 minus column 2.

the remaining 10. While nationally secondary to requirements for flood-plain protection, drainage ranks as the leading purpose in five major drainage areas: the Middle Atlantic, Gulf-South Atlantic, Great Lakes, Upper Mississippi, and Rio Grande-Gulf. Erosion control leads in the Southwest, California, and Hawaii.

The Columbia Basin is the only major drainage area in which irrigation outranks all other watershed project purposes in acreage needing treatment. Except for the Souris-Red and perhaps the Rio Grande-Gulf drainage areas, however, this review of irrigation project needs shows that watershed projects may have a considerable influence on future irrigation development in the United States.

**Other water management needs**

Water-management needs for rural domestic and municipal-industrial water supply or quality control, and wildlife habitat and recreational purposes were also considered in the In-

ventory. But these were not completely or uniformly evaluated. Consequently, these data, particularly on recreation, must be regarded as estimates of only minimum needs.

Work plans being prepared under Public Law 566 and studies of the Outdoor Recreation Resources Review Commission indicate that the 834 (823) watersheds reported as needing water-supply development and 1,955 watersheds as needing recreation development (fig. 64, table 60) are much less than the present total potential for these purposes in small-watershed projects.

The Commission in its report to the President said (ORRRC 1962, p. 135) :

> The broad scope of the small watershed program places it in a particularly favorable position to contribute to public recreation opportunities. Most of the Nation's small watersheds, including many adjacent to metropolitan areas, are eligible for treatment.

Recent amendments to the Watershed Protection and Floor Prevention Act provide for Federal cost sharing for recreation development in watershed projects and in the 11 watersheds authorized by the Flood Control Act of 1944. The cost sharing covers construction; land rights for access roads, parking lots, picnicking, and beach areas; and facilities needed for use of the developments. All forms of outdoor recreation that are based on the use of or nearness to water in reservoirs, natural streams, or shorelines are included.

Indications are that most of the structures already built in watershed projects are being used for recreation, primarily for fishing and swimming. With greater Federal assistance available, many more local organizations will want to include these and other forms of recreation in projects now being carried out or authorized for planning.

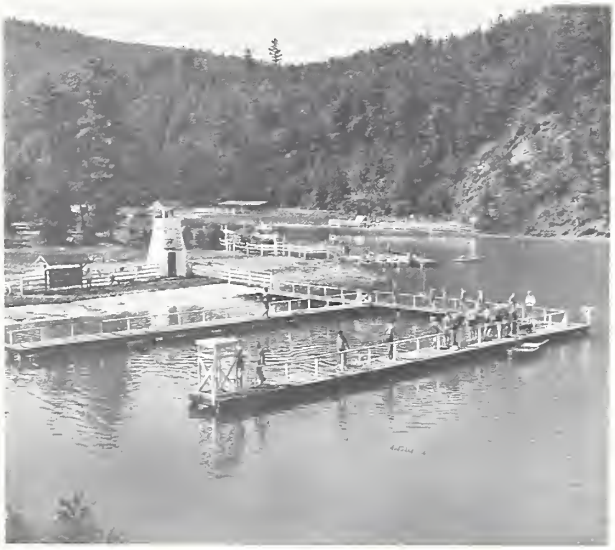

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***Figure 64.*—Public recreation facilities can be installed to make use of the small lakes created by floodwater-retarding dams and other structures in watershed projects.**

TABLE 60.—*Watershed projects needed for rural water supply and recreation development, 1958*

[Because of rounding, some totals may not equal the sum of the items listed and data may not check exactly with summary tables]

BY MAJOR DRAINAGE AREAS

| Area or region | Watersheds needing projects for water supply | Area needing development for recreation | Watersheds needing recreation projects |
|---|---|---|---|
| | *Number* | *1,000 acres* | *Number* |
| New England | 30 | [1] 2 | [1] 30 |
| Middle Atlantic | 126 | [1] 140 | [1] 185 |
| Gulf and South Atlantic | 182 | [1] 144 | [1] 170 |
| Tennessee Valley | 27 | 5 | 74 |
| Ohio Basin | 172 | [1] 177 | [1] 257 |
| Great Lakes—St. Lawrence | 33 | [1] 91 | 104 |
| Upper Mississippi | 19 | [1] 74 | 111 |
| Lower Mississippi | 3 | [1] 117 | [1] 87 |
| Eastern mainland | 592 | [1] 748 | [1] 1,018 |
| Arkansas–White–Red | 98 | [1] 103 | [1] 152 |
| Souris–Red | 10 | [1] 32 | [1] 26 |
| Rio Grande and Gulf | 44 | [1] 46 | 89 |
| Missouri Basin | 53 | [1] 216 | [1] 257 |
| Columbia Basin | 4 | [1] 82 | [1] 93 |
| North Pacific | 21 | 246 | 39 |
| Great Basin | — | 215 | 109 |
| Central Valley | — | 163 | 57 |
| Colorado Basin | 1 | 72 | 90 |
| Central and South Pacific | — | 23 | 25 |
| Western mainland | 231 | [1] 1,298 | [1] 937 |
| U.S. mainland | 823 | [1] 2,046 | [1] 1,955 |
| Hawaii | 11 | — | — |
| U.S. total | 834 | [1] 2,046 | 1,955 |

BY FARM PRODUCTION REGIONS

| | | | |
|---|---|---|---|
| Northeast | [1] 97 | [1] 128 | [1] 205 |
| Lake States | [1] 25 | [1] 139 | [1] 91 |
| Corn Belt | [1] 96 | [1] 209 | [1] 305 |
| Northern Plains | [1] 90 | [1] 165 | [1] 142 |
| Appalachian | [1] 315 | [1] 90 | [1] 329 |
| Southeast | [1] 71 | [1] 114 | [1] 161 |
| Delta States | [1] 8 | [1] 157 | [1] 82 |
| Southern Plains | 92 | 54 | 107 |
| Mountain | [1] 4 | [1] 403 | [1] 325 |
| Pacific | [1] 25 | 587 | 208 |
| U.S. mainland | [1] 823 | [1] 2,046 | [1] 1,955 |
| Hawaii | 11 | — | — |
| U.S. total | [1] 834 | [1] 2,046 | [1] 1,955 |

[1] Data incomplete because some counties (States) did not inventory this item.

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# *Appendix*

## DEFINITIONS

Following are definitions of the major items included in the Conservation Needs Inventory and summarized in the tables of this report. They are listed in the approximate order of the tables in which they first appear.

### Land-Capability Classes

#### Land suitable for regular cultivation:

**Class I.** Soils that have few or no conditions that limit their use. They can be safely cultivated without special conservation treatment.

Soils in this class are suited to a wide range of plants and may be used safely for cultivated crops, pasture, range, woodland, and wildlife. They are nearly level and erosion hazard (wind or water) is low; they are deep, generally well drained, and easily worked; they hold water well and are either fairly well supplied with plant nutrients or highly responsive to inputs of fertilizer.

The soils in class I are not subject to damaging overflow. They are productive and suited for intensive cropping. The local climate is favorable for growing many of the common field crops. Soils in class I that are used for crops need ordinary management practices to maintain productivity—both soil fertility and soil structure.

**Class II.** Soils that have some natural condition that limits the kinds of plants they can produce or that calls for some easily applied conservation practice when they are cultivated.

Soils in this class require careful soil management, including conservation practices, to prevent deterioration or to improve air and water relations when the soils are cultivated; the limitations are few and the practices are easy to apply.

These soils may be used for cultivated crops, pasture, range, woodland, or for wildlife food and cover but they provide the farm operator less latitude in the choice of either crops or management practices than soils in class I. They may also require special soil-conserving cropping systems, soil conservation practices, water-control devices, or tillage methods when used for cultivated crops.

**Class III.** Soils that have more serious or more numerous limitations than those in class II and are more restricted in the crops they can produce or, when cultivated, call for conservation practices more difficult to install or keep working efficiently.

These soils may be used for cultivated crops, pasture, woodland, range, or for wildlife food and cover.

Their limitations restrict the amount of clean cultivation; timing of planting, tillage, and harvesting; choice of crops; or a combination of these. The limitation may be natural—such as steep slope, sandy or shallow soil, or too little or too much water. Or the limitation may be erosion brought on by the way the land has been used.

#### Land suitable for limited cultivation:

**Class IV.** Soils that have very severe limitations that restrict the kinds of plants they can grow. When cultivated, they require very careful management and conservation practices are more difficult to apply and maintain than on soils of class III.

These soils may be used for crops, pasture, woodland, range, or for wildlife food and cover.

Many sloping soils in class IV in humid regions are suited for occasional but not regular cultivation. In subhumid and semiarid regions soils in class IV may produce good yields of adapted cultivated crops in years of above average rainfall; low yields in years of average rainfall; and failures in years of below average rainfall. In the low-rainfall years the land must be protected even though there can be little or no expectance of a marketable crop.

#### Land generally not suitable for cultivation:

**Class V.** Soils that have little or no erosion hazard but have some condition impractical to remove that limits their use largely to pasture, range, woodland, recreation, water supply, or wildlife food and cover. They have limitations that restrict the kind of plants that can be grown and that prevent normal tillage of cultivated crops.

These soils are nearly level but are wet, are frequently overflowed by streams, are stony, have climatic limitations, or have some combination of these limitations.

**Class VI.** Soils that have severe limitations that make them generally unsuited for cultivation and restrict their use largely to pasture, range, woodland, recreation, water supply, or wildlife food and cover.

Physical conditions of soils placed in class VI are such that it is practical to apply range or pasture improvements, if needed, such as seeding, liming, fertilizing, and water control with contour furrows, drainage ditches, diversions, or water spreaders. Depending upon soil features and local climate the soils may be well or poorly suited to woodland.

Some soils in class VI can be safely used for the common crops provided unusually intensive management is used; some are adapted to such special crops as sodded orchards or blueberries that require soil conditions unlike those demanded by the common crops.

**Class VII.** Soils that have very severe limitations that make them unsuited for cultivation and that restrict their use to pasture, range, woodland, recreation, water supply, or wildlife food and cover with careful management.

The restrictions are more severe than for soils in class VI because of one or more continuing limitations that cannot be corrected and that make them unsuited for common cultivated crops. Also, the physical conditions are such that it is impractical to apply such pasture or range improvements as seeding, liming, fertilizing, and water-control measures such as contour furrows, ditches, diversions, or water spreaders. Depending upon the soil characteristics and local climate, soils in this class may be well or poorly suited to woodland.

**Class VIII.** Soils and landforms that have limitations that prevent their use for commercial plant production and that restrict their use to recreation, water supply, or wildlife food and cover with careful protection.

These soils and landforms cannot be expected to return significant on-site benefits from management for crops, grasses, or trees, although such benefits from wildlife use, watershed protection, or recreation may be possible. Badlands, rock outcrop, sandy beaches, riverwash, mine tailings, and other nearly barren lands are included in class VIII.

### Land-Capability Subclasses

**Subclass e, erosion hazard.** Soils in which the susceptibility to erosion is the dominant problem or hazard in their

use. Erosion susceptibility and past erosion damage are the major soil factors for placing soils in this subclass.

**Subclass w, excess water.** Soils in which excess water is the dominant hazard or limitation in their use. Poor soil drainage, wetness, high water table, and overflow are the criteria for determining which soils belong in this subclass.

**Subclass s, unfavorable soil.** Soils in which the soil characteristics of the root zone are the dominant limitation in their use. These limitations are such factors as shallow soils, stoniness, low moisture-holding capacity, low fertility difficult to correct, and salinity or sodium.

**Subclass c, adverse climate.** Soils in which climate (lack of moisture or low temperature and short growing season) is the major hazard or limitation in their use.

## Land Uses

**Cropland.** Land currently tilled, including cropland harvested, crop failure, summer fallow, idle cropland, cropland in cover crops or soil-improving crops not harvested or pastured, rotation pasture, and cropland being prepared for crops or newly seeded. Cropland also includes land in vegetables, fruits, and nuts including those grown on farms for home use. All tame hay (and also wild hay harvested east of the Mississippi and that from irrigated land west of the Mississippi) was included as cropland. Meadowland was considered as cropland when it had soil and water conditions capable of producing a hay crop in normal years, was used primarily for the production of hay harvested nearly every year, and was locally considered as cropland rather than as pasture or range. The hay could consist of either native or introduced species.

**Irrigated cropland.** Cropland to which water is usually applied by artificial means.

The 1958 acreage includes only cropland which was irrigated in 1957. Irrigated cropland was recorded in the 17 western mainland States.

**Pasture and range.** Land in grass or other long-term forage growth used primarily for grazing. Pasture and range includes grassland, nonforested pasture, and nonirrigated wild hay harvested west of the Mississippi and other grazing land with the exception of pasture in the crop rotation. It may contain shade trees or scattered timber trees with less than 10 percent canopy, but the principal plant cover is such as to identify its use primarily as permanent grazing land. It does not include extensive acreages in the following categories which are grazed but are included in forest and woodland: Chaparral, pinon-juniper woodlands of the West, and grassy forested areas with more than 10 percent tree canopy.

**Forest and woodland.** (a) Land which has at least 10 percent canopy of forest trees of any size and capable of producing timber or other wood products or capable of exerting an influence on the water regime; (b) land from which the trees described in (a) have been removed to less than 10 percent canopy and which has not been developed for other uses; (c) afforested (planted) areas; and (d) chaparral areas.

**Other land.** All agricultural land not classified as cropland, pasture and range, or forest and woodland.

**Urban and built-up areas.** Land in cities, villages, and other built-up areas of more than 10 acres; industrial sites, railroad yards, cemeteries, airports, golf courses; the intensively used and built-up parts of shooting ranges and institutional and public administrative sites; and highways, public roads, railroads, and airports. The acreage of farmland inside city and village limits was included in the Inventory acreage.

**Water areas.** Water areas smaller than 40 acres and streams and canals less than ⅛ mile wide. This acreage is only listed under "Water areas" in table 1; it was excluded from the Inventory acreage after the survey of the sample areas. (Larger water areas were already excluded from the total acreage.)

## Conservation Problems on Cropland

**No problem.** Class I land, which has no conservation problems except those that are related to the restoration and maintenance of fertility and tilth and that can be solved by methods generally used in the community.

**Dominant (or secondary) problem of erosion.** Land on which water or wind erosion has occurred or will likely occur under the expected use. Land-capability subclass e.

**Dominant (or secondary) problem of excess water.** Land on which excess water caused by a high water table or by temporary flooding prevents or limits the use of conservation cropping systems and practices. Land-capability subclass w.

**Dominant (or secondary) problem of unfavorable soil.** Land on which an unfavorable soil condition in the root zone, such as salinity, sodium, acidity, low fertility, stoniness, shallowness to rock, or low moisture-holding capacity, limits root development. Land-capability subclass s.

**Dominant (or secondary) problem of adverse climate.** Land on which extremes in either precipitation or temperature or both are the major problem and limitation on use. Land-capability subclass c.

## Conservation Problems on Pasture and Range

Acreages needing establishment of cover, improvement of cover, or protection of cover do not overlap, it being understood that establishment or improvement includes the necessary protection. Acreages for different kinds of protection, however, may overlap.

**Establishment of vegetation.** The acreage expected to be converted from other uses into pasture and range, plus acreage in pasture and range in such poor condition in 1958 that it needed to be completely reestablished.

**Improvement of plant cover.** The acreage on which the plant cover was inadequate in 1958 but which could be restored to satisfactory condition by improvement measures short of complete reestablishment.

**Protection of plant cover.** The 1958 acreage needing protection from one or more of the following:

**Overgrazing.** The acreage with inadequate plant cover that could be restored to satisfactory condition by the management of livestock or installation of supplemental water facilities.

**Fire.** The acreage with serious fire hazards that could be protected by installation of fire-prevention measures.

**Erosion.** The acreage of gullied or other seriously washed and windblown areas that needed control measures to prevent further deterioration.

**Rodents.** The acreage with serious rodent damage that could be corrected by chemical, mechanical, or other measures.

**Encroachment of woody and noxious plants.** The acreage on which encroachment of woody and noxious plants had destroyed or was threatening the grass cover and which could be protected by chemical or mechanical means. This acreage does not include any pasture on which woody and noxious plants would be eradicated in the establishment or reestablishment of pasture.

**Water Management:**

**Excess water.** The 1958 acreage on which excess water prevented the establishment, maintenance, and use of desirable plant cover.

**Water conservation.** The 1958 acreage on which desirable vegetation could be feasibly established or improved by water-conserving measures.

## Conservation Problems on Forest and Woodland

There are no overlaps between (1) the acreage needing establishment of timber stand, (2) the acreage needing improvement of timber stand, and (3) the acreage needing control of erosion. The sum of these three is listed under the column "Needing treatment." The acreages of the other problems may overlap these three and one another. Estimates were made for the following problems:

**Establishment and reinforcement of timber stand.** This acreage is made up of three components: (1) Land expected to shift to forest and woodland from other uses by 1975 except the acreage that needed trees to check erosion and the acreage of shelterbelts and windbreaks; (2) land classified as forest and woodland in 1958 less than 10 percent stocked or stocked with unsatisfactory species; (3) land in forest and woodland more than 10 percent stocked in 1958 but needing reinforcement. Ordinarily this did not include any acreage with a canopy of 40 percent or more. The estimated acreage includes only the number of acres which the reinforcement planting would equal in complete establishment. For example, if a total area of 50,000 acres needed reinforcement but it was estimated that the planting needed to accomplish this would be equal to only 35,000 acres of full-scale establishment, the 35,000 acres was the area included in the estimate.

**Improvement of timber stand.** The 1958 acreage of forest and woodland on which stand-improvement measures were feasible under good management. Estimates were limited to acreages expected to return the cost of improvement investment within 15 to 20 years.

**Protection of timber stand from:**

**Fire.** The acreage of forest and woodland which in 1958 was not receiving protection adequate to meet the fire situation in the worst years and under critical conditions.

**Insects and disease.** The acreage of forest and woodland in 1958 not effectively protected from insect and disease outbreaks.

**Animals, including rodents.** The acreage of forest and woodland which in 1958 was not receiving adequate protection from animals, including rodents, and on which protection was feasible under good management. The estimate includes the need for protection from domestic animals.

**Erosion control.** The acreage expected to be planted to trees to halt erosion, plus the acreage of forest and woodland on which erosion-control and water-disposal measures were needed to check gullies, control sheet erosion, stabilize dunes and blowouts, contain slides, and control logging-road and skid-trail erosion.

**Establishment of shelterbelts and windbreaks.** The acreage on which windbreaks and shelterbelts were needed and feasible to influence wind current and thus reduce soil blowing, control snowdrifting, conserve moisture, and protect buildings, fields, gardens, and feedlots.

**Improved naval stores methods.** Forest and woodland expected to be operated for naval stores production in 1975 that will need to be operated under improved naval stores methods.

## Conservation Problems on "Other Land"

Estimates of conservation needs for "other land" were made in the same way as for cropland, using the same definitions of problems.

## Watershed Project Needs

**Watershed.** Any drainage area of not more than 250,000 acres that would be a feasible unit for dealing with flood prevention and water-management problems.

**Watershed-project problems.** Water-management problems within the scope of the Watershed Protection and Flood Prevention Act (Public Law 566) that cannot be solved by the individual actions of the people affected by the problems.

**Acreage having problem.** The total acreage subject to the watershed project problem, even though it may have been solved already. For example, the acreage of land with floodwater damage problems includes all land naturally subject to flooding even though it may now have adequate protection. The estimates of acreages having each watershed project problem were provided by the Soil Conservation Service for non-Federal land and by the responsible agencies for Federal land.

**Project action.** Cooperative action that can be effected only through formal organizations having legal status in the State and with powers to negotiate contracts, levy taxes, make assessments or otherwise raise funds, and to disburse funds for the installation, operation, and maintenance of works of improvements. The principal benefits of project action are ordinarily off-site.

**Acreage needing projects.** The acreage having the problem that cannot be adequately protected or treated by individuals without project action as defined above. This same acreage may also require assistance under other programs.

**Farms benefiting.** The number of farms having some acreage with the problem that requires project action.

**Floodwater damages.** Direct and indirect damages by floodwater to homes, industries, towns, agriculture, roads, bridges, recreational facilities, and the like.

**Sediment damages.** Damages due to deposition of sediment in stream and drainage channels or infertile outwash on flood plains, silting of reservoirs, swamping or impairment of drainage on flood plains, damage to water supplies, and similar effects of sediment deposits.

**Flood-plain area.** Both main-stem and tributary flood plains in all watersheds.

**Critical-erosion area.** Critically eroding areas on uplands such as gullies, logging roads, diversions, and stream banks that are serious sediment sources and that can be controlled only through group action.

**Drainage problem area.** Areas of level or nearly level land that require adequate group outlets for removal of excess water not directly attributable to flooding. Includes areas now drained.

**Area drained.** Areas drained and used for agriculture in organized drainage districts as reported by the Agricultural Census.

**Remaining drainage problem area.** That part of drainage problem area not adequately served with group outlets; i.e., drainage problem area minus area drained, as defined above.

**Irrigable area.** Land that has water shortages during critical growing seasons and that is potentially irrigable on the basis of suitability of soil and availability of water. Includes areas now irrigated but excludes those where irrigation is clearly infeasible economically.

**Area fully irrigated.** Land now irrigated with adequate water for satisfactory crop production. This acreage was calculated as the difference between the area now irrigated and that irrigated with insufficient water.

**Remaining irrigated area.** That part of the irrigable area not now being irrigated or being irrigated with insufficient water; i.e., the irrigable area minus area fully irrigated.

**Nonagricultural water management problems.** Inadequate supplies of water for domestic, livestock, industrial, recreational, or fish and wildlife purposes or for sustaining low stream flows to reduce pollution or salt water intrusion. These data are considered incomplete because some counties and States did not inventory these needs. Moreover, after the Inventory began there have been changes in demand for water for these uses and in legislative authorities for watershed projects.

**Water-supply development.** Locally recognized needs for inclusion in multipurpose projects of storage and facilities for municipal or industrial water supply, stockwater development, or rural domestic supply to meet existing demands in 1958.

**Recreation development.** Locally recognized needs for inclusion in multipurpose projects of additional storage and facilities for recreational purposes under conditions and legislative authorities in effect in 1958.

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